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ANDERSON COMPASS

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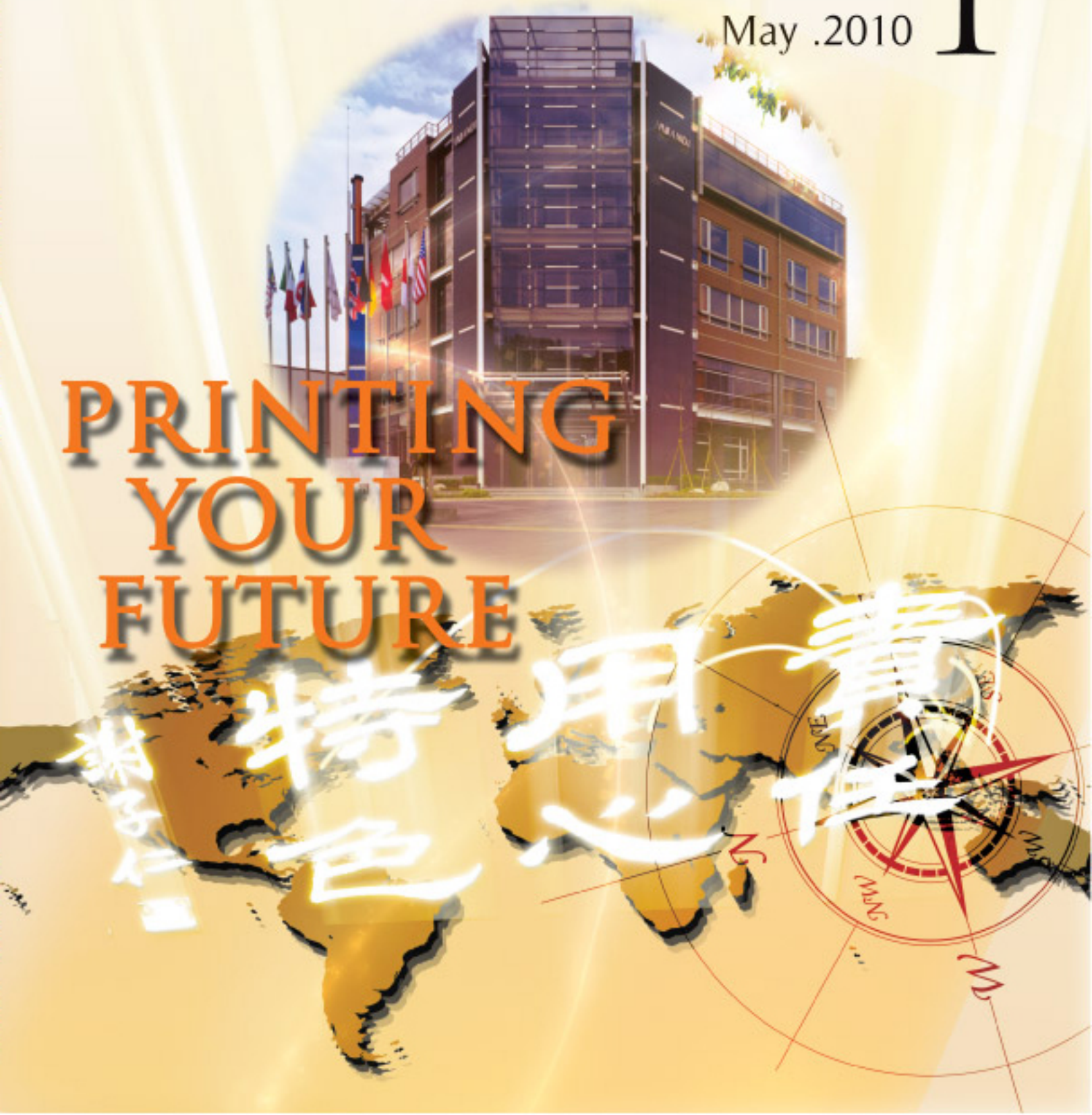

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總公司 Head Office　　後龍工廠
10456 台北市中山區松江路72號7樓
7F, NO.72, Sung Chiang Rd., Zhongshan District,
Taipei ,10456, Taiwan
Tel :+886-(0)2-2523-7866
Fax:+886-(0)2-2523-6676

後龍工廠 Anderscon Taiwan Factory
35651苗栗縣後龍鎮中華路1498號
NO.1498, Chung-Hua Rd., Hou-Lung,
Miao-Li ,35651, Taiwan
Tel :+886-(0)37-726-876
Fax:+886-(0)37-727-727

電子機械部 PCB DIVISION
33859桃園縣蘆竹鄉南崁路一段99號8樓之1
8F-1, NO.99, Sec.1, Nan-Kan Rd.,
Luchu, Taoyuan ,33859, Taiwan
Tel :+886-(0)3-311-4366
Fax:+886-(0)3-311-4333

北區營業處 Anderson Taiwan-North
33859桃園縣蘆竹鄉南崁路一段99號11樓之1
11F-1, No.99, Sec. 1, Nan-Kan Rd., Luchu,
Taoyuan ,33859, Taiwan
Tel :+886-(0)3-311-4366
Fax:+886-(0)3-311-0288

中區營業處 Anderson Taiwan-Central
43541台中縣梧棲鎮經二路33號
NO.33, Jing 2nd Rd., Wuci Township,
Taichung County ,43541, Taiwan
Tel :+886-(0)4-2659-5866
Fax:+886-(0)4-2659-3199

南區營業處 Anderson Taiwan-South
80661高雄市前鎮區中山二路91號13樓之6
13F-6, NO.91, Jhongshan 2nd Rd.,
Cianjhen Dist., Kaohsiung ,80661,Taiwan
Tel :+886-(0)7-335-0066
Fax:+886-(0)7-338-1868

翔德光電 DPC
22101 台北縣汐止市新台五路一段81號19樓之5
19F-5, NO.81, Sec.1, Sintai 5th Rd., Sijhih City,
Taipei ,22101, Taiwan
Tel :+886-(0)2-2698-4500
Fax:+886-(0)2-2698-0758

總格實業 Sogotec
40768 台中市工業區37路11號
NO.11, 37th Rd.,Taichung Ind. Area,
Taichung ,40768, Taiwan
Tel :+886-(0)4-2359-1131
Fax:+886-(0)4-2359-6925

恩德美國公司 Anderson America
10710 Southern Loop Boulevard,
Charlotte, NC, 28134 USA
Tel :+1-704-522-1823
Fax:+1-704-522-0871

恩德德國公司 Anderson Europe
Am Oberen Feld 5, D-32758 Detmold Gemany
Tel :+49-5231-9663-0
Fax:+49-5231-9663-11

恩德新加坡公司 Anderson Sigapore
BLK459 PASIR RIS RD-4 #10-257(S)
510459, SINGAPORE
Tel :+65-65840749
Fax:+65-65814828

恩德上海工廠 Anderson Shanghai Factory
上海市松江區方塔北路648號
NO.648, Fang-Ta North Rd., Songjiang District,
Shanghai, China
Tel: +86-(0)21-5774-3650
Fax:+86-(0)21-5774-3656

華東地區 Anderson China-East
上海市松江區方塔北路648號
NO.648, Fang-Ta North Rd., Songjiang District,
Shanghai, China
Tel: +86-(0)21-5774-3650
Fax:+86-(0)21-5774-3656

華北地區 Anderson China-North
北京市豐台區科學城星火路11號寫字公園A座1028室
Room 1028 ,Tower A, NO.11,Xinghuo Rd.,Sience Park,
Fengtai District, Beijing,China
Tel :+86-(0)10-63789239
Fax:+86-(0)10-63789230

華南地區 Anderson China-South
廣東省深圳市寶安區松崗鎮燕川惠明盈工業園
12棟2樓西區
2F, Building12,YanChuan Huimingying
Industry Zone,Songgang Town,Shenzhen,
Guangdong,China
Tel: +86-(0)755-2705-9851
Fax:+86-(0)755-2705-9850

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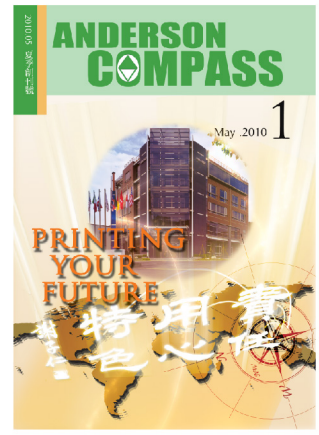

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總編輯：王元男
編輯：陳慧玲　黃淑君
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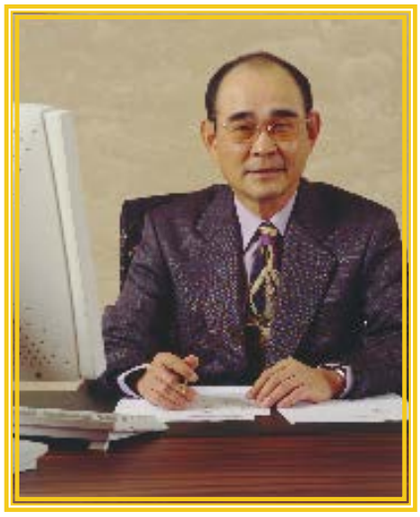


歷經世紀罕見的全球金融海嘯，無數的企業因此滅頂，從此消失，恩德集團在驚濤駭浪中一步一腳印的走過，我們活下來了，然而，在如此巨大的經濟衝擊之後，前面的挑戰依然嚴峻，我們沒有鬆懈的本錢，唯有掌握明天過後的旺盛求生意志，才能在景氣復甦依舊步履蹣跚的全球市場立於不敗之地，並為下一波的繁榮預作佈局；期盼恩德集團的全體同仁時時戒慎恐懼、努力用心，我們才有可能繼續活下去，也才有可能『贏』！大家共勉之！

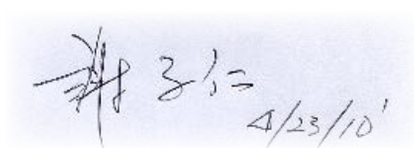
恩德集團是〝立足台灣、縱橫全球〞的國際化企業，工作同仁分佈於全球各地，因此，發行這一份刊物，有以下兩個主要的目的：（一）讓內部的同仁，以及外部的股東、供應商、客戶…等，能持續瞭解恩德集團在技術、產品、組織、管理…各方面的發展與進步。（二）做為內部同仁一個溝通的平台，進而促進全體同仁的向心力、責任感，激發全體同仁不斷用心創造恩德集團的特色。

一份刊物，看似單純，其實籌畫、邀稿、聯繫、編撰…過程繁瑣，需要長時間、有毅力的規劃與執行，而且還得依賴大家熱心參與，才有可能持續下去；期盼恩德全體同仁共襄盛舉，一起來豐富這個屬於大家的園地，這一份屬於恩德集團全體同仁的刊物也才有可能成長茁壯。大家共勉之！

After the visit by the global financial tsunami unforeseen in the century, numerous enterprises were wiped out and disappeared. Anderson was able to survive the tsunami with its solid-grounded operations. However, challenges continue in the wake of economic turmoil of this magnitude. There is no time for a break. We must move on with even greater energy in order to stand tall while the global market staggers on the way to recovery and pave the way for the next round of prosperity. It is expected that all employees at Anderson are on alert and work hard at all times. This is the only way that we can continue to survive and “win”! Let’s do it!

The Anderson Group is an international enterprise that is based in Taiwan and reaches out to the whole world. Our colleagues are found all over the world. This publication is issued primarily for two purposes: (1) to keep internal employees and external shareholders, suppliers, and customers updated on the development and advancement Anderson makes in terms of technology, products, organization, management, among other aspects; and (2) to serve as a communication platform for internal colleagues in order to boost coherence and sense of responsibility to all employees and inspire them to constantly devote themselves to the creation of Anderson traits.

A publication looks simple but actually encompasses complicated processes such as planning, articles solicitation, correspondence, compilation, etc. It requires long-term perseverant planning and execution and relies on hearty participation by everyone to keep on going. It is encouraged that everyone at Anderson participates in the publication effort and work together to nurture this garden that belongs to everyone and help this publication of Anderson’s grow strong. Let’s do it!



總編輯的話 Editor's Note

今年初，集團總裁 謝董事長指示發行恩德集團技術期刊，隨即授意本人籌劃創刊事宜，本人惶恐銜命，忐忑中組成編輯小組，經三個月的奔走、努力，在所有同仁、好友的鼎力協助下，及編輯小組日以繼夜經歷無數星辰，終於完成首刊並如期發行。本人再次致上最高的謝意，由於你們的犧牲與辛苦付出，恩德技術期刊得以邁開最重要的第一步。

“指南車”的設計是一典型的機械傳動原理，相傳為中國黃帝軒轅首創，是古代偉大的機械發明。期刊命名"ANDERSON COMPASS”是期盼恩德集團成為機械業的領導者，宛如指南車的發明，恩德集團將在機械領域為人類做出更多的貢獻；未來期刊內所發表的文章與論述，無論是技術、管理、生活、娛樂等，將提供給集團同仁一個全方位的思維與學習，一如指南車指引人的方向。

Early this year, president of the Group, Mr. Hsieh expressed his idea for publishing the Anderson Group Technology Periodical and soon authorized me with the preparations. I was nervous while accepting the mission and formed the editing panel. With three months of hard work and devotion and thanks to the hearty support from many colleagues and friends as well as the numerous sleepless nights devoted by the editing panel, the periodical was successfully debuted. I would like to express my utmost thanks again. Because of your sacrifice and hard work, the Anderson Group Technology Periodical started the most important first step successfully. 。

The design of the “compass chariot” is based on a typical mechanical drive principle. It was said to have been invented by Xuan-Yuan, the Emperor of China and was a great mechanical invention. The “Anderson Compass ” looks up to the Anderson Group as the leader in the machinery industry. Just like the invention of the compass chariot, the Anderson Group will make more contributions for the mankind in the mechanical field. In the future, articles and theses published in the periodical covering technology, management, life, and entertainment will provide the group staff with omnipresent series of thoughts and learning opportunities, just like the compass chariot offering humans guidance in the right direction.

王元男 Jason Wang
from Anderson Group

PCB 文字噴墨的發展

The Development of PCB Character Inkjet

噴墨技術的發展

UV 硬化技術由 1970 年代開始發展，起初是為解決環保問題而開發出相關的油墨與塗料。後因 UV 油墨的優異性，如硬度高、色衰慢、低溶解性、硬化速度快、低溫硬化、環保等，而吸引全世界油墨業者積極開發各式油墨。今日的油墨技術，縱使被印物是不吸墨，但經由 UV 照射後，油墨還是可固化並牢固的附著在物體上。另外由於噴墨頭廠商，致力於發展新的噴墨頭，配合 UV 快乾配方的研發，順利的將油墨從噴墨頭擠壓出來，且不會在噴印時乾掉堵塞噴墨頭，讓 UV 油墨成功的印到物體。油墨與噴墨頭，兩者技術的不斷突破，才有今天各式新興的應用場合。

常見的 UV 油墨組成包括 1. 單體；2. 寡聚合物；3. 光起始劑（photo initiator）；4. 助劑 additive。組成油墨的成份與比率，完全視被印物的材質特性而定。玻璃、塑膠、紙張、PCB 等，既有各自有效的油墨組成關係。按需噴墨技術是工業上最普遍的噴墨頭技術，按需噴墨技術是僅在需要噴墨的圖文部分噴出墨滴，而在空白部分則沒有墨滴噴出。這種噴射方式無須對墨滴進行帶電處理，噴頭結構簡單，容易實現噴頭的多嘴化；基於壓電噴墨的噴印技術最具發展潛力，恩德集團於 2007 年開始投入大量的人力、物力，配合噴墨頭的供應商，積極開發噴墨頭的控制卡與相關軟體。PCB 文字噴墨設備，即是此技術所延伸的產品。

PCB文字噴印的需求

PCB 的文字印刷雖然不是一道困難的製程，製程中也沒有特別高的精度要求。一般常見的 PCB 板文字規範，最小線寬為 0.127mm(5mil)，文字高度為 1.0mm，印刷位置的公差為 ±0.25mm 。但製板、對位、脹縮、漏墨、積墨、張

TheDevelopment of PCB Character Inkjet

The technology of UV curing was developed by the 1970s. Initially, it had been developed the related ink and coating to solve the environmental problem. Then, it affected the ink manufacturers all over the world to develop all kinds of ink actively due to its superiority in hardness, slower color decline, low solubility, high speed of curing, low temperature for hardening and environment, etc. The ink of current technology can be solidified and firmly attached on the objects after irradiated by UV, even if the printed objects do not absorb ink. Besides, due to the manufacturers of printhead had committed to the development of new printhead, and match up with the developments of UV quick-drying recipe, they had achieved the goal of squeezing the ink out from printhead successfully, without congestion and transfer UV ink onto the object successfully. Both of the ink and printhead technologies had made constant breakthroughs, which led to all kinds of new applications today.

Common ingredients of UV printing ink including: 1. monomer, 2. oligomer, 3. photo initiator, and 4. additive. The ingredients and ratio of the ink depends completely on the characteristic of printed material. Such as glass, plastic, paper and PCB, each of them had their own effective composition relationship of ink. Drop-on-demand technology is the most popular printhead technology in the industry, which only spray ink drops in figures and article texts that's required to be printed, and no ink drops will be sprayed on the blank part. This spray type requires no live processing for ink drops, and the printhead can be easily multiplied due to its simple structure. Due to piezoelectric inkjet technology has the most potential of development, Anderson Group started to invest numerous manpower and material resources in 2007, to cooperate with the printhead suppliers and develop the control card and related software. The equipment of PCB character inkjet is the extension product of this technology.

力等繁瑣的惱人問題，也常令製程管理者傷透腦筋。特別是越來越多少量多樣的需要，加上急單的壓力。 PCB 的文字印刷確實已成為製程中急待克服難題。有鑑於此，早在 2000 年開始，就有相關的研究團體，試圖以噴墨技術引用到 PCB 的文字製程，但因市場相關技術，如噴頭的精度、油墨等未成熟，終究產品無法滿足市場需求。但近年來，隨著噴頭技術的大躍進，油墨問題也相繼克服。使得機械設備商得有機會，開發更符合市場需求的設備。恩德集團也看好此設備在市場的潛力，及此設備對 PCB 製程的重要性，技術團隊在克服相關整合技術後，在 2010 年，正式推出 PCB 文字噴印設備 -PCB Legend。

恩德集團在Inkjet設備應用

恩德集團除了將 Inkjet 應用在 PCB 產業外，近年來技術團隊也成功的將此技術拓展到、廣告、建材、家具等各行業。因此專門用於建材、家具的硬材噴印，有 Cojet 系列產品因應而生。 同時專對 PVC、紙類的軟質材料，也有 LEXUSJet 等系列產品，這一系列的相關設備，提供給客戶全方位的解決方案。更重要的是，這些設備完全是恩德集團的技術團隊獨立完成，所以技術團隊累積了不同材料的噴印控制技術與噴印知識，相較於其他單一領域的競爭對手，恩德集團有更充裕的知識與人才，協助客戶解決製程上的所有困擾。

The Demand of PCB Character Printing

Although PCB character printing is not a difficult process, which does not have any particular requirement of precision, the general character specification of PCB are listed as follow: the minimum line width is 0.127mm(5mil), text height is 1.0mm, the tolerance of printing position is ±0.25mm, but it also brings so much trouble to the process engineer with the complicated problems of board making, alignment, expansion and shrinkage, leaking ink, accumulating ink and tension, etc. Especially, the demand of an increasing small amount of diversity modes and the pressure of urgent P/O. PCB character printing has really become a problem to overcome in the process. Therefore, the related research groups tried to bring the inkjet technology into the process of PCB character printing from the year 2000, but the related market technologies such as the printhead precision and ink, etc, were not mature yet at the time, so the product was still not satisfying the market demand. But in recent years, the mechanical equipment manufacturers had the opportunities to develop the equipments to meet the market demand by the significant progress of printhead technologies and conquered the problems with ink. Anderson Group recognizes the market potential of the equipment and its importance to the process of PCB. The technical team had conquered the related integration technology and released the equipment of PCB character inkjet -PCB Legend- in 2010.

Anderson Group for the Application of Inkjet Equipment

Anderson Group's Inkjet technology has been applied to the industry of PCB. Furthermore, the technical team has expanded the application of the technology to industries such as advertisement, building materials, furniture in recent years. Therefore, the Cojet series are applied to the industries of building materials and furniture for inkjet printing on hard materials. Meanwhile, the LEXUSJet series are applied to soft materials such as PVC and paper. All the related series equipments are provided to the customers for the full range solutions. More importantly, all the equipments are developed entirely and accomplished independently by the technical team of Anderson Group, so the team had accumulated the technology of inkjet printing control and inkjet printing knowledge for different applications. Compared with competitors who only specialized in this field, Anderson Group has more sufficient knowledge and specialists to assist our customers to solve the problems in the process.

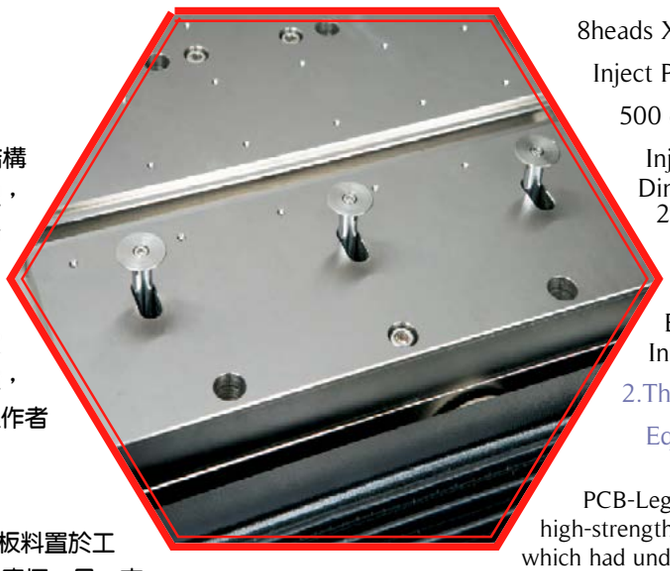
PCB Legend 的基本規範

1. 機械基本規格

檯面尺寸:750mmX 850mm
噴頭規格: 8 heads X 128 nozzles
噴印精度: 500 dpi ~ 1000 dpi
噴印尺寸: 24in X 28in
列印速度: 40sec(500dpi雙向列印)
墨滴尺寸: 30PL

2. 精密的機台

PCB-Legend 機台是由高強度的結構剛材組合而成，並施以嚴謹的退火處理，將結構強度與穩定性極大化，提供機台精密移動的基本需求。XYZ 三軸均以高剛性高精度的線軌做為軌道，配合精密無間隙的螺桿，提供機械精確的定位與極佳的重覆度。全罩式的機台外罩，給與操作者安全的操作環境，並避免操作者因 UV 產生光害，保護操作者的雙眼。



3. 簡易的操作介面與板料固定

在噴印的作業程序中，首先需將板料置於工作台上，所以板料要定位並找出基準點座標。另一方面圖檔的讀取、圖檔格式的轉換、列印參數的設定等複雜的前置作業，對操作者而言確實是煩惱的問題。恩德集團軟體部門，將整個複雜的準備工作，以人性化的簡易操作界面，快速的達成以上程序需求。 對於客戶少量多樣的操作要求，提供較便利的解決方案。對於機械的基本相關設定與噴頭的參數設定，系統提供另一層次的操作環境，僅授權充分了解設備設定的技術人員，得以操作修改。避免一般作業人員設定錯誤，影響機械的正常運作。PCB 板置於台面上時，除了使用機台的真空吸著來固定板料外，系統也提供可移動式的香菇頭來夾持板料四周，確保板料在噴印時能平整噴印，以維持整板的噴印品質。

4. CCD 對位與脹縮補償功能

文字噴印前，PCB 板在規劃上必需有基準對位的對位點，一般以圓點標靶或十字標靶為主，本系統可對以上符號或客戶自行定義的圖形來當對位點。PCB Legend 先以 CCD 快速取像，配合 Pattern Match 對位功能，找出實際對位點的機械座標，再配合數值的計算、座標的轉換、SIZING 技巧等，計算出 PCB 板的實際膨脹系數與旋轉角度，提供系統自動補償，以提升文字噴印的位置精度。

5. UV 固化控制

UV 油墨的固化必需配合 UV 燈的照射，時間、速度、能量需要有不同的控制，以確保固化的品質。PCB-Legend 結合 UV 燈與 UV 的控制，客戶可選擇噴印完立即固化或離線後再固化，方便不同製程的考量。除此之外，PCB-Legend 對 UV 有更寬廣的設計，除了時間與速度可由系統自行設定外 ，UV 系統也擁有三段能量控制，可分別適應於不同的油墨厚度或不同的油墨材質。

The Basic Specification of PCB - Legend

1.The Basic Specification of Equipment

Table Dimension:

750mmX850mm Printhead:
8heads X 128 nozzles
Inject Printing Resolution:
500 dpi ~ 1000 dpi
Inject Printing Dimension: 24in X 28in
Printing Speed: 40sec(500dpi Bidirectional Print)
Ink Drop Size: 30PL

2.The Precision of Equipment

PCB-Legend is consisted of high-strength structural steel, which had undergone the rigorous annealing to maximize the structural strength and stability to provide the basic demand of the equipment 's precise movement. The tracks of XYZ axes are made of linear rails with high rigidity and precision, which cooperate with precise backlash free ball-screw for providing the equipment with high precise repeatability positioning. The full-covered housing of equipment provides the operators a safety operation environment, avoids light pollution generated by the UV and protects the operators' eyes.

3.The Simple Operation Interface and Board Fixed

During the printing process, firstly it needs to put the board on the operated table, then the board has to be orientated and the reference point coordinates has to be found. On the other hand, it's complicated for the operators to do the complex preparation such as the images file reading, the images file format conversion, and the print parameters setting. The software department of Anderson Group simplifies the complicated preparations by using a simple user-friendly interface to accomplish the rapid demanded procedure mentioned above. And it provides the convenient solution for the customer's operation demand of a small amount of diversity modes. With regarding to the basic relative setting of the equipment and parameters of printhead, the system will provide another level of operation environment which only authorized to the technicians who realize the equipment setting completely to revise the operation, avoiding the common operator setting error that influencing the equipment function. The vacuum clamping system fixed the board when PCB is on the table, furthermore, the system will also provide the movable mushroom head to fasten around the board for ensuring the board will be entirely flat while printing, to maintain the print quality of the entire board.

6. 自動供墨與溫控

不同的油墨可能需要不同噴墨溫度，系統必需有完善的溫控，以確保噴墨的順暢與品質。PCB-Legend 除供墨系統有完善的加熱溫控外，在噴墨頭上也有精密的溫度控制，使油墨從油槽到噴嘴的流動過程中，油墨黏度維持穩定，確保噴墨過程中每滴油墨的大小均一一致。這些專業的處理，操作者可以透過參數的簡單設定，即可完成此複雜的溫度控制程序。

7. 噴孔防塞與清潔功能

PCB 生產過程中，生產可能因料號的更換或產能計畫的需求，機械必須停機使用，如此油墨常會因停機過久，造成阻塞噴頭。特別是長時間停機，當設備再開機使用時，更須要徹底的清潔噴頭，以確保油墨供應流暢。PCB-Legend 可提供不同層次的清潔、保養方式，方便操作者應用於不同的作業情況。簡易的待機循環功能，由機械在噴完板料時，即自動啟動。第二層次的清潔防塞，是由操作者在停止噴印時，配合機械的 Purge 功能鍵，直接清潔噴頭，再使用簡易的噴印測試軟體，確認每個噴嘴是否正確噴印無誤，此工作也可於每天開機時定期實施。第三層次的清潔，是使用清潔液清潔，需由認可的技術人員，透過系統提供的工具，直接清潔噴嘴內部。

結論

PCB 文字噴墨，不僅是彈性製造的需求，也是未來環保意識高漲，最好的解決方案。PCB 產業一直以來被視為高污染的行業，所以各國政府無不致力，重新制定 PCB 的製程標準，特別鼓勵 PCB 產業開發新製程，以增層法的製程概念，替代原本的減層法製程概念，以期改善目前 PCB 製程污染問題。恩德集團也體認未來強烈的環保訴求，願意投入更多的人力與物力，發展更多增層法概念的設備，一起與 PCB 業者共同拼手努力，提供更環保的設備，開創更美好的生活環境。

4.CCD Alignment and the Compensation of Expansion and Shrinkage

Before printing the character, the PCB has to be planned with the position location for alignment, generally the main target symbols are dot or cross, the system can identified the graphics defined by customers or the above mentioned symbols to align position. PCB Legend will take a quick image by CCD, and then cooperate with the alignment function of Pattern Match to find out the machine coordinates of the actual position. Moreover, to cooperate with the calculation of the data, coordinate conversion, SIZING skill, and obtain the actual expansion coefficient and rotation angle, to provide the system with auto-compensation for enhancing the precision of character inkjet printing.

5.UV Curing Control

UV ink curing has to cooperate with the different control with time, speed and energy of UV light irradiation to ensure the curing quality. PCB-Legend had combined the UV light with UV control to provide the customers selections of curing after inkjet printing immediately or the curing after off-line to fit different process requirements conveniently. Besides, PCB-legend has a broader design on UV. Other than the time and speed can be set by the system, the UV system also has 3 sections of energy control to adapt the different ink thickness or ink material respectively.

6.Automatic Ink Supply and Temperature Control

Different type of ink needs different printing temperature; so the system must have perfect temperature control in order to ensure the smoothness and quality of the print. For PCB-Legend, in addition to ink-supplied system with perfect temperature control, the printhead also equipped the precise temperature control to keep the ink viscosity stable while ink flows from the tank to the nozzle and ensure each ink drop is in the same size during inkjet process. For these professional demand, the operators can simply set the parameters, and the complicate temperature control procedure can be completed.

7.Anti-Plug of Nozzle and Cleaning Function

In the process of manufacturing PCB, the equipment may be shut down due to changing material number or planning the demand of capacities. Therefore, the ink will cause obstructions in the nozzles due to prolonged shut-down, especially for long period shut-down. Nozzles shall be completely cleaned after a long period shut-down, to ensure the ink supplier runs smoothly when the machine is turned on. PCB-Legend can provide different level of clean-up functions and maintenance which operators can apply conveniently to different situations. The simple stand-by function will start automatically after the completion of the printing. The second level of anti-clog cleaning is the function for the operators to cooperate with the Purge function button of machine to clean the nozzle directly when it stopped printing, and then it shall use the simple software of print test to confirm that each nozzle is functional without faults, this function can also be implemented regularly every day when the equipment was powered on. The third level of cleaning shall use cleaning agent to clean the internal part of the nozzle directly through tools provided with the system by authorized technician.

Conclusion

PCB character inkjet is not only the demand of flexible manufacturing, but also the best solution of the strong awareness of environment protection in the future. So far, PCB industry has been regarded as one of high pollution industries, so the government of every countries had pay efforts to reformulate the standard of PCB process, and especially encourage the development of the new process, to use the process concept of increasing layers to replace the original process concept of reducing layers, in order to improve the pollution problem of recent PCB manufacturing process. Anderson Group recognizes the strong aspiration of environment protection in the future and is willing to invest more manpower and material resources to develop more equipment of increasing layers concept and work together with PCB manufacturers for providing more environment-friendly equipments and create more wonderful living environment.

■ 李明哲 Tommy Lee
from Anderson Group

精微加工設備在影像、量測的結合應用

Integrated Application of Micro-Machining Equipment in Imaging and Measurement

前言

隨著科技的發展，不論在工業產品及消費性商品均是朝向微小化方向發展，使得相關零組件的尺寸日趨精細化。近年來電子、光電、生醫領域更是對高精度微小元件有強烈的需求，而這些零組件的特徵是尺寸通常小於 10㎜ 以下，其表面也往往需要具有 1 ～數百 μm 大小的微結構，以達到某些特定光學、電氣、流道等功能。因此，這些微小零組件的加工方法與傳統大尺寸零件的製作方式有顯著的不同，必須使用精微加工技術來克服加工問題。

由於精微加工設備所欲加工之目標物，與傳統工具機，在精確度及工件尺寸有著巨大差異，所以設備本身，除了機台須具備高精度外，其他週邊相關設備也必須採用相對應不同的設計，譬如在線工件量測。在加工領域中，工件量測一直扮演著品質最終守門員的角色，但通常來講，手動量具的操作是需仰賴操作者的技術水準。另傳統方式需將工件由機台上取下量測，若不在允差範圍時，又需將工件放回重新定位再做加工尺寸修正，極易引入人為工件設定誤差。尤其精微加工技術中，高精度微小元件的表面微結構，是如此精細，離線量測的不確定性大幅增加，故如何在加工過程中，可直接於精微加工設備內進行尺寸的確認，以提供給操作者便利性，並且大幅排除人為誤差，是必須被重視。

Introduction

As technology advances, both industrial products and consumer products are getting smaller and smaller and the size of related parts and components is getting refined on a daily basis, too. For the past few years, the demand for high-precision tiny components in the electronic, photonic, and biomedical industries has been strong. A common characteristic for these parts and components is that their size is usually smaller than 10mm, and their surface also often requires a micro structure of 1 to several hundreds of μms in order to achieve certain optical, electric, and flow channel functional requirements. Therefore, processing of these micro parts and components is singificantly different from that of traditional parts and components. Micro-machining technology is required to solve the processing problem.

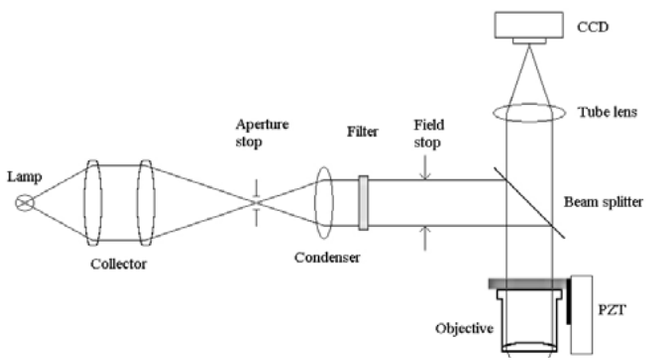
Due to the fact that targets to be processed by micro-machining equipment vary from traditional machine tools in terms of precision and size of the workpiece, the equipment itself must not only includes a highly precise machine set but also other peripherals with different corresponding designs, e.g. to enable the workpiece to be measured on line.

In the processing field, measurement of workpiece has been playing the role of a quality goalkeeper. However, generally speaking, the operation of manual measuring tools is highly depend on the technical skill of opertors. In addition, traditionally, workpiece needed to be removed from the machine to be measured. If the difference is not within tolerance, the workpiece has to be placed back to the machine and repositioned to have the processing size modified, which is prone to manned workpiece setting errors. With the micro-machining technology, the surface micro-structure of highly precise micro components is so refined that the uncertainty associated with off-line measurement is greatly increased. Therefore, how to directly confirm the size of a workpiece while it is inside the micro-machining equipment while being processed, in order to bring the operator with maximum convenience and significantly eliminate artificial errors is something that must be emphasized.

量測原理介紹

大致來說，量測方式可分為兩類：一為機械觸針式，另一則為光學非接觸式。在工件特徵結構細小化的考量下，為了避免刮傷的疑慮，因此通常會使用非接觸式微輪廓儀量測。非接觸式微輪廓儀大多採用光學干涉原理。在不同的光源中，由於白光的同調性差，可產生干涉範圍甚小只有幾微米，且可獲得相當漂亮且對比明顯的條紋，因此可以盡量避免如雷射光源會有條紋混淆而引起量測錯誤之缺點，所以採用白光掃描干涉儀(圖1)，應用於精微加工設備線上量測功能的開發上。

圖 1 (資料來源:工研院量測中心)
Figure 1: (Source: Center for Measurement Standards, Industrial Technology Research Institute)



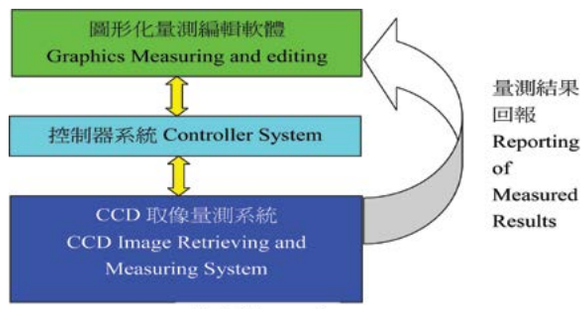


圖 2 Figure 2

Introduction to Principle of Measurement

Generally speaking, measurements can be divided into two ways: the machine probe method and the optical touch-free method. In light of the fact that stucture characteristic of workpiece are getting smaller and smaller, to avoid scratching workpiece, the touch-free micro-profiler is often used. Touch-free micro-profilers are mostly operating on the principle of optical interference. Among different sources of light, the coherence of white light is bad and the scope of interference it can generate is rather small, only several microns, so it can produce rather beautiful strips with significant contrast. Therefore, it helps to avoid the shortcoming of laser beams to producing confusing strips and causing measurement mistakes as possible. As such, the white light scan interferometer (Figure 1) is applied in the development of the online measurement function of micro-machining equipment.

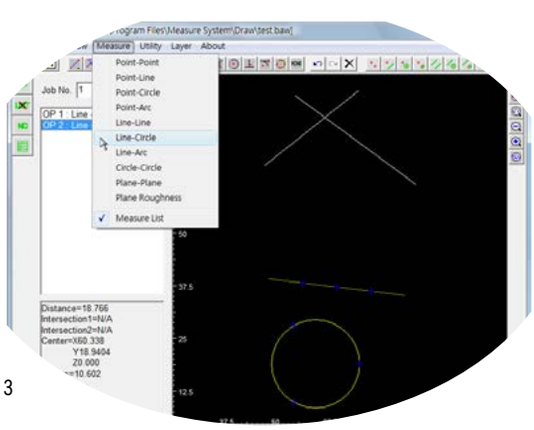


圖3
Figure 3

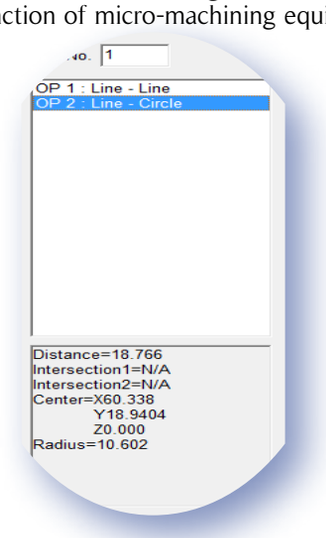


圖4
Figure 4

系統架構說明

目前恩德所發展的精微加工設備線上量測系統其主要的組成可由 圖 2 進行概要說明。其基本組成可分為三大區塊 1. 圖形化量測編輯軟體 2. 控制器 3. CCD 取像量測系統

圖形化量測編輯軟體功能概述如下： 軟體輸入工件的 DXF 檔，並顯示於畫面上，操作者透過圖形操作介面，將所欲量測的尺寸，在介面上予以規劃設定（見圖 3，4)，軟體會自動產生出取像 MACRO 程式，交由控制器執行。目前所規劃

的量測項目，除了有距離、直徑、夾角等量測功能外，也可進行表面粗糙度量測。

控制器及 CCD 取像量測系統功能概述如下： 控制器將所輸入的 MACRO 程式進行解譯，並將 CCD 鏡頭組移至編輯軟體所通知之拍攝位置，透過 TCP/IP 通知遠端 CCD 取像量測系統進行影像的取像，接受到取像指令時，CCD 軟體會進行影像取像，完成後，再通知控制器移動至下一取像點。同時 CCD 軟體會進行影像的處理，依據之前，輸入的 MACRO 量測指令，進行不同的種類的量測組合計算，如點至點、點至線、圓心、半徑等相關數值，再將結果回傳至軟體上，讓客戶輕易的了解目前加工的尺寸。 另針對已取像原始 3D 形貌資料，合作發展 CCD 模組的工研院量測中心，提供另外軟體（圖 5，6），可針對操作者感興趣影像區域，進行更多的量測動作如剖面線、粗糙度等量測。

Description of System Framework

The micro-machining equipment online measurement system developed by Anderson, its primarily comprises parts is briefly introduced in Figure 2. The components can basically be divided into three categories: 1. Graphics Measuring and Editing Software, 2. Controller, and 3. CCD Image Retrieving and Measuring System.

The functions of the graphics measuring and editing software are briefly described below: The DXF file was entered into the software and displayed on the screen. The operator plans and sets the size to be measured through the graphics operator interface (See Figures 3 and 4) and the software will automatically show the image retrieving MACRO program and the control will run the program. Items to be measured that have been planned by far include measurements of distance, diameter, angle, and surface roughness.

The functions of the control and the CCD image retrieving and measuring system are briefly introduced below: The control translates the entered MACRO program and moves the CCD lens to the editing software-informed filming location, and informs through TCP/IP the remote CCD image retrieving and measuring system to retrieve images. When the image retrieving command is received, the CCD software will start retrieving images and informs the control to move to the next image retrieving location once it is completed. Meanwhile, the CCD software will process images and calculates and combines different types of measurements, e.g. from point to point, from point to line, center and radius

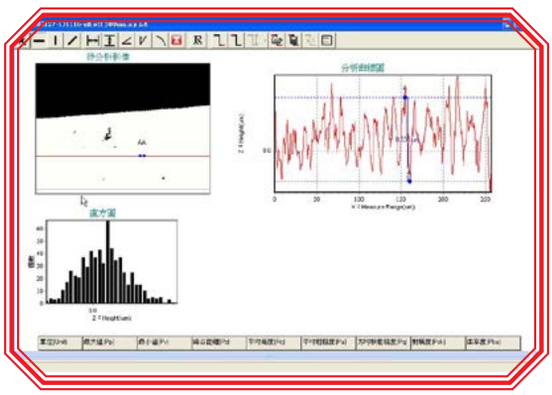


圖 5
Figure 5

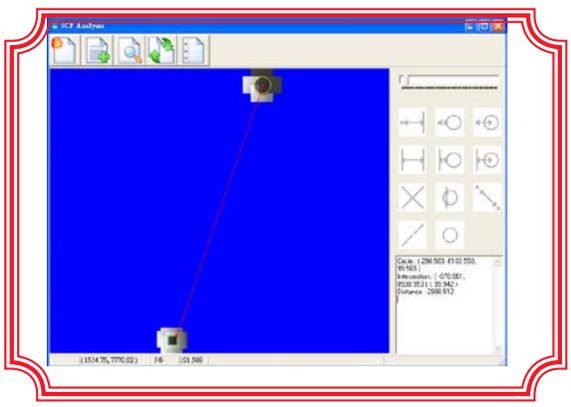


圖 6
Figure 6

of the circle, among other values based on the previously entered MACRO measurement command. Then, the results will be sent back to the software, so that customers can easily understand the size currently being processed.

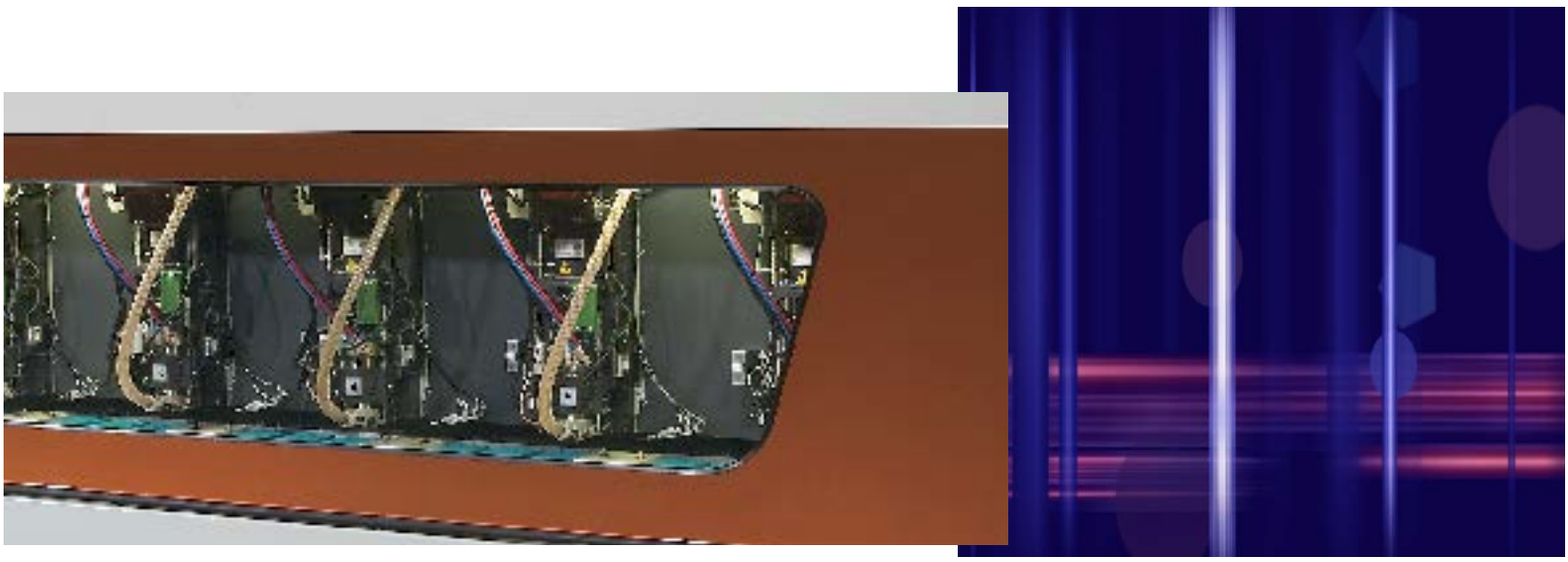
In addition, for the original 3D image data already obtained, the Center for Measurement Standards of the Industrial Technology Research Institute partnering with us in the development of the CCD module will provides another software (Figures 5 and 6), which can perform more measurements, e.g. measurements of cross-sectional lines, roughness based on the image sections the operator is interested in.

結論

在今日科技急速推進的浪潮裡，設備本身也必須朝著複合化、智能化前進。如何幫助使用者更快速、更精確的完成工作，是設備製造商的使命，而 CCD 線上量測系統正是幫助完成此使命的功能之一。在未來，恩德科技仍會繼續努力不懈，以提供更多更好產品及功能，服務客戶。

Conclusion

As the technology advances quickly nowadays, equipment itself must also develop toward systhesis and intellectualization. How to help users to complete tasks more quickly and precisely is the mission of equipment manufacturers, and the CCD online measurement system is exactly one of the tools to help accomplish this mission. In the future, Anderson will continue to work hard in order to provide more and better products and functions to serve our customers.



PCB 鑽孔機鑽孔孔偏分析

The Analysis of Hole Declination of PCB Drilling Machine

謝銘雄 Ming-Hsiung Hsieh
from Sogotech

印刷電路板（Printed Circuit Board/Printed Wiring Board, PCB/PWB）幾乎會出現在每一種電子設備當中，是提供電子零組件安裝時的載體，除用來固定各種小零件外，PCB的主要功能是提供上頭各項零件的相互電流連接，以達成中繼傳輸訊號之目的，使各項零組件得以發揮整體功能，為所有電子資訊產品中不可或缺的基本構成要件。隨著電子設備越來越複雜，需要的零件越來越多，PCB上頭的線路與零件也越來越密集了。 由於PCB的技術一直在進步當中，表一為目前一般PCB廠的技術層次規格。而對於孔偏現象產生的不合格條件為孔邊距離錫墊(Pad)邊小於2mil，即為不合格孔。

PCB (Printed Circuit Board/Printed Wiring Board, PCB/PWB) has appeared in almost every device, provided as carrier while installing electronic parts. In addition to fixing the various components, the main function of PCB is to combine each of components by current connection to complete the purpose of relaying transmission of signals and achieve the integral function of the components and parts, so it is the indispensable basic element for all electronic products. The More and more complicated the electronic devices become, it will need more and more components, so circuits and components on PCB have become more and more concentrated.

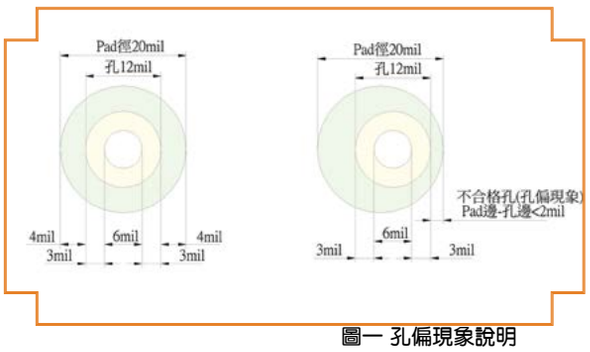
Due to the technologies of PCB are progressing continuously, the following table shows the current technical level specification of the general PCB factories. The unqualified condition of hole declination is that if the distance between hole edge and pad edge is less than 2mil, it's an unqualified hole.

不合格孔（孔偏現象）＝錫墊 (Pad) 邊 - 孔邊 <2mil

Unqualified Hole (Hole Declination) = Pad Edge to Hole Edge < 2mil

因高密度係指 4mil（含）以下 (≤4mil；0.1mm) 之線路，一般設計主要以孔徑的左右留邊

各 4mil 錫墊 (Pad) 為常見，如圖一所示。



圖一 孔偏現象說明

Figure 1, Hole Declination Description

High density means that the circuit is under 4mil(included) (≦4mil ; 0.1mm). It is popular for a general designer to left a 4mil pad margin for both left and right sides of the hole diameter, as shown in figure 1

印刷電路板經由電路設計，將連接電子零組件的線路繪製成配線圖，再將配線圖案製作成底片，而後在銅箔基板上經過圖形顯像，並經過數道流程：內層線路、壓合、鑽孔、鍍通孔、一次銅、外層線路、二次銅、防焊綠漆、文字印刷、接點加工、成型切割、終檢包裝。其中鑽孔製程的品質如孔位精度及孔壁品質，將影響後面製程及產品的良率。而本篇文章將針對鑽孔孔偏原因進行探討，應細分為人員、設備、材料、方法、環境、量測等細項。

PCB is made through the processes listed below: First, draw circuit layout via circuit design for circuits which connect the components and parts together. Then, develop the circuit pattern into film, and show the image on copper-clad laminate (CCL), and by some flow chart: inner-layer circuit, laminating, drilling, plated through hole, panel plating, outer circuit, second panel plating, solder green mask, legend, contact processing, cutting after being shaped, final inspection and package. In equality of drilling process, such as hole accuracy and hole wall quality, will influence the yield of next following process and production. This article will discuss on the causes of drilling hole declination, then described in detailed items such as operator, equipment, material, method, environment and measurement.

項　目 Item	一般產品技術層次 The General Technology Level	中、高階產品層次 The Medium, High-End Level
層數 Layer	2 - 12 層 2 – 12 Layers	8 - 18 層 8 -18 Layers
產品疊構 Lay-Up Structure	一般硬質電路板 General Rigid Circuit Board	盲 / 埋 孔及增層法疊構 Blind Hole / Buried Hole and Lay- Up Structure
最小鑽孔孔徑 Minimum Hole Diameter	10-12 mil (0.3mm)	8 mil (0.20mm)
最小雷射孔徑 Minimum Laser Diameter	6 mil (0.15mm)	4 mil (0.1mm)
最大縱橫比 Maximum Aspect Ratio	6.0/1.0	8.0/1.0
外層線路之線寬 / 距 The Circuit Width / Distance of Outer Layer	4/4 mil	3/3 mil
內層線路之線寬 / 距 The Circuit Width / Distance of Inner Layer	4/4 mil	3/3 mil
最小 SMT 焊墊間距 Minimum SMT Solder Pad Pitch	16 mil (0.40 mm)	12 mil (0.31 mm)
最小 BGA 焊墊間距 Minimum BGA Solder Pad Pitch	40 mil (1.0 mm)	30 mil (0.75 mm)

表一、目前PCB技術層次表
Table 1, The Current PCB Technology Level.

人員

鑽孔機操作人員對於設備操作的熟悉度、細心度及生理狀態都會有些影響，例如：參數輸入錯誤、鑽針放置錯誤、多層板加工定位 PIN 不正、TWO-PIN 作業放置錯誤等，而這些錯誤可以經由 SOP 的訂定及 QC 檢視即可立即改善。

Operator:

It will be influenced by the operation equipment familiarity, elaboration and physiological condition of the drilling machine operator, such as parameter input error, drill bit installation mistake, the locating PIN of multilayer processing was placed obliquely and TWO-PIN operation placement error, which can be improved immediately by setting up SOP and QC inspection.

設備

鑽孔機的機器狀態好壞對於孔偏影響很大，例如：機台水平、螺桿背隙、光學尺補償值、機台震動等都會有影響，其次是夾 PIN 點的固定插銷配合度不良，造成電路板的移動，機械定位精度不良，造成偏移，因此機器進行的定期保養與清潔及雷射定位精度補償是非常重要的。集塵壓力過大或不足也會造成下鑽同心度不佳及排屑不良而造成孔偏，因此必須設定適當的集塵壓力及壓力腳環進氣口截面。刀具對於孔偏現象也具有相當程度的影響， 例如：鑽頭強度不足、鑽頭磨耗過大、鑽尖點幾何形狀有誤、研次過多，所以選用刀具必須考慮強度、耐磨性、排屑空間、幾何形狀等等條件。主軸方面就是 run-out 問題，當 run-out 過大孔偏現象也會相對出現，因此需要定期清潔主軸並在一段時間內進行主軸內部保養清潔或更換。PWB 在上 PIN 時因固定方式不佳導致上 PIN 的時候就發生植 PIN 的偏差，如圖二所示，容易鑽出孔偏、孔破（孔飄）的問題板材。

Equipment:

Firstly, the condition of drilling machine will affect greatly on hole declination, such as equipment collimation, ball screw backlash, optical ruler compensation, and machine vibration will all cause effect on hole declination. Secondly, the fixing latch of clipping PIN has low adaptability, which will cause the movement of PCB board. Further, undiscovered low mechanical accuracy will cause the offset of the machine. Therefore, it is very important to perform regularly on maintenance, cleaning and the compensation of laser locating accuracy. Larger or less of dust collection pressure will also cause poor drilling concentricity and bad chip extraction, which will both led to hole declination, therefore, it has to adjust the suitable dust collection pressure and the air inlet cross-section of pressure foot ring. Cutters will also influence considerably on hole declination, such as insufficient drill strength, large drill wear, wrong geometric shape on drill top point, excessive grinding, so it shall be considered carefully on selection by strength, wear resistance, space for chip extraction and geometric shape. When it comes to the spindle, the Run out problem appears, that's due to its appearance, the hole declination will also appear relatively. Therefore, spindle shall be cleaned regularly and maintained or replaced its internal within a period of time. Due to the poor fixation method of PWB on pinning causes bias insertion of PIN, as shown in figure 2, which will easily occur the problem of hole declination and hole void on board.

圖二 上PIN作業誤差說明

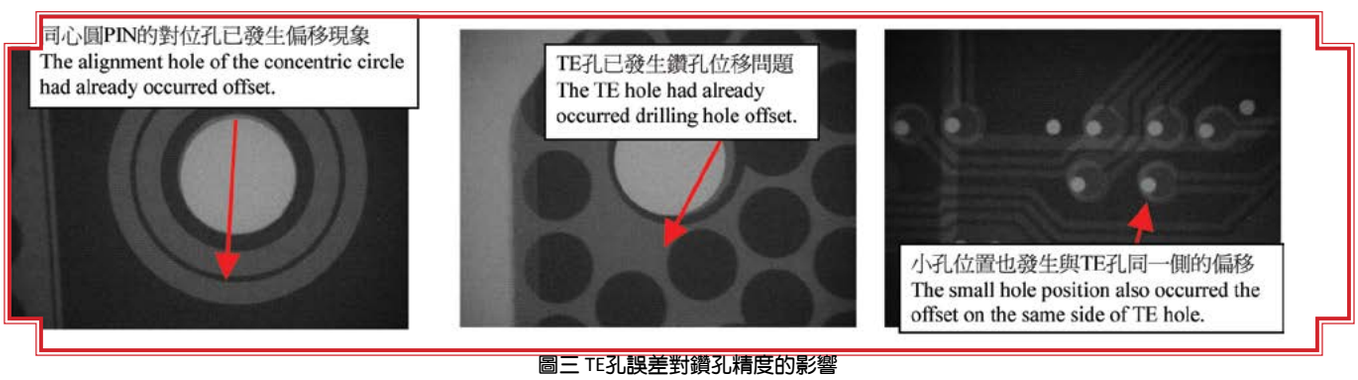
Figure 2, The Error Operation of Pinning.

材料

PWB 材料目前可分為雙面板及多層板，就雙面板而言，孔偏現象與材料有關的就是外層線路製作時的漲縮問題，這一部份除鑽孔精度的影響外就是線路加工時環境溫度不同對材料所造成的尺寸漲縮，因此溫度影響的部分也必須加以管控。就多層板而言，除外層線路製作時的漲縮問題外，就是內層線路對位誤差會影響到鑽孔精度的良劣。而多層板的定位孔（TE 孔）加工誤差也會影響鑽孔精度，如圖三所示。上蓋板的厚度對於鑽針的磨耗、刀口積屑有明顯的影響，所以必須選用合適的上蓋板對於鑽孔精度有幫助。PWB 疊板不恰當也會使上蓋板、PWB 有間隙而造成粉塵堆積進而造成孔偏。

Material

Currently, PWB material can be divided into double-sided and multi-layer board. For double-sided board, the material-related reason of hole declination is the sizing problem while outer layer circuit production. In addition to the influence of drilling accuracy, it's the different environment temperature which will cause dimension sizing problem on material while circuit processing. Therefore, the influence of temperature shall also be controlled. For multi-layer board, in addition to the sizing problem of outer layer circuit production, it's the positioning tolerance of inner circuit will influence the drilling accuracy quality. The processing tolerance of TE hole of multi-layer board will also affect drilling accuracy, as shown in Figure 3. The thickness of upper cover board will obviously influence the wear of drill bit and cutter chip load, so it will be helpful to the drilling accuracy if suitable upper cover board



圖三 TE孔誤差對鑽孔精度的影響

Figure 3, The Effect of TE hole tolerance on Drilling Accuracy

was selected. An improper lamination will cause the gap between the upper cover board and PWB, which will accumulate dust and led to hole declination.

方法

鑽孔過程中必須控制的參數有主軸轉數、進刀速、退刀速、鑽針的鑽孔數、材料的疊板數、鑽針研次數等都會影響到鑽孔精度的良劣。主軸轉速過高或過低會導致切削阻抗過大或鑽尖殘焦渣等而造成孔偏，疊板數過多時會造成切削阻抗增大導致鑽針磨耗而影響鑽孔精度，所以適當的疊板數及適當的鑽孔數才能提升鑽孔精度，增加良率。良好的方法需透過實驗的數據後經由數字化的結果得到所要的參數，再利用建立 SOP 方式教導操作人員，如此才能得到穩定的產品品質。

Method:

During the drilling process, you must control the parameters of spindle rotation speeds, feeds, retractations, quantity of drill bit holes, material lamination quantity and grinding times of drill bit, that all of them will influence the qualities of drill accuracy. If the spindle speed is too high or too low, it will led to large cutting resistance or cinder remains on drill bit top and

finally cause hole declination. When there are too many laminations, it's going to cause increasing cutting resistance, which will led to the wear of drill bit and influenced drilling accuracy. Therefore, only proper quantity of lamination and drill bit holes can increase drilling accuracy and yield. A better method needs to depend on the experiment data which are digitized and turned into the parameters for setting up the SOP to instruct the operators, thus, it can make the product in stable qualities.

環境

鑽孔作業廠房一般為溫控廠房，可以使機台在穩定的環境進行鑽孔作業，但是當廠房內部有額外的熱源而對環境產生溫度變化，就會造成機台結構尺寸上的變化進而產生鑽孔孔偏，因為熱溫昇導致機台結構尺寸變化，一般是不會立即發掘的，而且鑽孔機的長度大約 4M 左右，一點點的溫度變化就會有很大的尺寸變化，一般鑄件材料膨脹係數為 1°C 有 11um 的變化，但是當我們發現時可能已經發生相當程度的孔偏報廢損失，因此這一部份應該相當注意。其次是 PWB 材料在輸送過程的溫度與機台加工時的溫度不同時，是否會有材料漲縮問題必須加以研究，或是 PWB 材料加工時必須在加工廠房放置相當的時間，使材料恢復穩定的狀態。鑽孔廠房對於溫度要求是一個穩定的溫度而不是一個低溫的溫度。另外鑽孔時的材料溫度與外層線路製作時的材料溫度差異，對於孔位精度是否有所影響及程度有多少，或許應該進行統計分析。其次是量測材料時的環境溫度及材料溫度相對材料加工時的溫度不一樣時，對於量測結果有多少的變異性，這也是必須經由統計分析才能得知。

量測

PWB 經鑽孔作業後會進行鑽孔精度檢驗以確保後續製程不會發生問題，因此量測機台如 AOI、X-Ray 等檢測機都應該定期進行校正與保養，以確保量測結果的正確性。

Environment:

Generally, drilling operation plant is temperature controlled, so the equipment can work on drilling in a stable environment. However, when there are extra thermal resources from the plant and change the environment temperature, it will cause the change of dimensions of equipment structure, then led to drilling hole declination. Due to the increasing temperature will lead to the change of the dimensions of equipment structure, which will not be found instantly, moreover, the length of drilling machine is about 4 m and a little bit of temperature change will cause a great difference in its dimensions. Generally, the expansion coefficient of casting material is 1°C for the variation of 11um, but it may already occurred a considerable loss by hole declination when we discovered the change, thus, we should pay more attention to this issue. Secondly, it also has to be studied whether there would be the material sizing problem when PWB is in the different temperatures on delivery and process, or it should be put for a period of time before process for restoring the material to be stable in the plant. The drilling plant needs to be in a stable temperature, but not in a low temperature. Besides, perhaps it shall do the statistical analysis on whether the material temperature differences between drilling process and outer circuit production will cause effect on hole accuracy, and its degree. Furthermore, when environment temperature and material temperature while measuring materials varies from temperature of material under processing, it can be realized by the result of the statistical analysis on the variability of measurement.

Measurement:

It will make sure without any problem for the following process on inspecting drilling hole accuracy after PWB is drilled, therefore, it should be adjusted and maintained for the inspection devices, such as AOI, X-Ray to confirm the correct result of inspection.

結論

一個好的 PCB 產品必須經過數十或數百道加工程序才能完成，然而攸關成敗關鍵製程幾乎是在鑽孔作業，所以一個好的機器設備需搭配合適的刀具、適當的加工參數及適當的加工材料方能製造出完美的產品，而且這些因素都是環環相扣的，假使我們能夠一一將這些影響因素調整至最佳情況，就能夠生產出良好鑽孔精度的產品。

Conclusion:

A good quality PCB must be completed by the dozens or hundreds of processes, however, it almost depends crucially on the process of drilling operation. Therefore, a good equipment needs to cooperate with the correct cutters, the correct processing parameters and the correct processing material to manufacture a perfect product, moreover, these factors are linked together. If we can adjust these influential factors to the best situation, the product can be manufactured with superior drilling accuracy.

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玻璃研磨技術介紹
The Introduction of Glass Grinding Technology

彭建銘 Alex Pen
from AEMG

前言

近年來，觸控式面板的應用可說是越來越廣泛，從早期軍方作為軍事上的特殊用途，至今，民生用品等多處的廣泛應用。然而，觸控式面板技術有 4、5 種以上，其中，以電阻式觸控面板為市場主流，電容式次之，而這些技術大都是以玻璃作為相關應用，因此，玻璃材質的加工技術成為主要核心技術之一。

砂輪

選擇適當的砂輪，是決定玻璃加工成敗的關鍵，因此，想探討玻璃的加工技術，就必須先對砂輪充分的了解。砂輪主要是由磨料、結合劑及氣孔所構成，其各個功能如同圖 1 內容所述

砂輪早在多年前就被業界廣為使用，因此，砂輪的規格標示方法也已有了明確的定義，大致規格如同圖 2 所示。

磨料主要是由硬度較高的材料所構成，在此只要選擇比工作物硬度高的磨料，就不會發生磨料被磨耗的現象，這是由於磨耗只與硬度有關，但是，人往往將工作物使磨料破碎的狀況誤認為是磨料的磨耗，其實，磨耗指的是兩物之間的摩擦損耗關係，而磨料的破碎乃是指，物體受到外力撞擊下的破壞行為，此行為是與磨料的強度有關。

Introduction

For the past few years, the application of touch panels has gotten more and more extensive, from the early special application in the military to the widespread applications in many daily aspects nowadays. However, there are four or five types of touch panel technologies, among which the resistance type touch panel is the mainstream on the market, followed by the capacitance type. Most of these technologies are based on glass for correlative applications. Therefore, processing technology of glass material becomes one of the primary core technologies.

Sand Wheel

Chose the proper sand wheel will determine the success or failure of glass processing. Therefore, when discussing the glass processing technology, one needs to understand sand wheel thoroughly first. Sand wheel is primarily consists of abrasive material, binding agents, and air holes. Their functions are illustrated in the

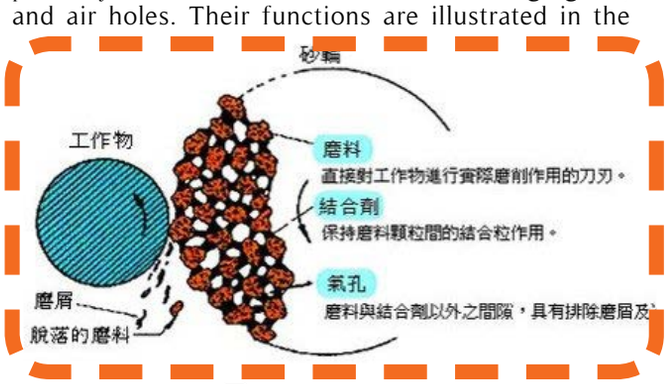


圖 1 (Figure 1)

粒度指的是每平方英吋篩網上的篩孔數目，粒度越高，代表所篩選的平均粒徑越小。目前在國內外尚未有統一的粒度標準，各個企業都有自己的粒度指標定義和表示方法。下表為不同標準篩與平均粒徑的關係。

SDC	200	N	75	B	1A1	3	150x10x31.75
磨料	粒度	硬度	集中度	製法	形狀	厚度	尺寸
D-天然鑽石	16 200 20 230 30 270 40 325 50 400 60 600 80 800 100 1000 120 1500 140 2000 170 3000	J K L M N O P Q R S T	25 50 75 100 125 150 175 200	M 金屬法 B 樹脂法 P 電鍍法 HM 硬焊法 V 瓷質法	參閱標準形狀	1 2 3 4 5	D X T X H (外徑x厚度x孔徑)
SD-合成鑽石							
SDC-金屬被覆合成鑽石							
CB-立方氮化硼							
CBC-金屬被覆氮化硼							

圖 2 (Figure 2)

粒度間接代表著磨料的粒徑大小，磨料粒徑大（粒度小），表示受結合劑接觸面積大，因而在相同強度的結合劑下，比小粒徑的磨料，更能承受較大的磨削力，其次，也代表著磨粒與磨粒間擁有較大的空間，使得冷卻液更容易進入冷卻及排除磨屑，由此

B.S.S 粒度#B.S.S. Granule#	170	200	240	300	350	400	500
A.S.T.M 粒度#A.S.T.M Granule#	170	200	230	270	325	400	500
TYLER 粒度#TYLER Granule #	170	200	250	270	325	400	500
平均粒徑μm Average Granular Diameter μm	90	75	63	53	45	37	25

B.S.S：英國標準篩、A.S.T.M：美國標準篩、TYLER：泰勒標準篩
B.S.S.: British Standard Screens; A.S. T.M: American Standard Screens; TYLER: Tyler Standard Screens

可知，粒度越小，研磨能力越好，但是，由於粒徑大之關係，表面粗糙度也相對較差，而用於硬脆的玻璃材料上，又代表著給予玻璃較大的外力，使得玻璃更容易產生較大的破碎點。

規格上的硬度，指的是結合劑與磨料間的黏結強度，並非磨料的硬度。硬度的強弱，由字母的大小來表示，字母越小（A）越軟，反之越硬。硬度選得過高，易造成磨料破碎後，仍未能脫落，而使得磨粒與磨粒間的空隙縮小，因而產生磨屑堵塞，且冷卻液不易進入冷卻等問題。反之，硬度選得過弱，造成磨料容易脫落，使得砂輪損耗過大，並很快失去砂輪正確形狀，進而影響研磨的品質。

集中度是指砂輪內部結構的鬆緊程度，鬆緊程度與磨料、結合劑和氣孔三者的體積比例有關。若以磨料佔砂輪體積百分比來劃分，以磨料佔 25% 稱為集中度 100；或以 1cm3 體積中，含有 0.88g(4.4cts，1cts=0.2g) 的磨料稱為集中度 100。集中度越大，表示磨料越緊密，磨粒與磨粒間的空隙就越小。下表為各集中度的磨料含量關係。

玻璃

強化玻璃是一種表面在壓縮狀態的玻璃。一旦破碎，會碎成小顆粒，不致傷人，故為安全玻璃的一種。使玻璃表面產生壓縮狀態的方法，有急冷法及離子交換法兩種。離子交換法可強化較薄玻璃，急冷法則以較厚玻璃較為容易。化學強化玻璃就是採用離子交換法。強化後之玻璃強度約增加五倍。

玻璃強化乃是增加玻璃強度，並非增加玻璃硬度，因此，強化玻璃對砂輪而言，會產生較大的磨削力，使得磨料發生

following figure.

Sand wheel have been widely used since many years ago. As such, the labeling methods of sand wheel specifications are well-defined. General specifications are shown in the following table:

Abrasive material is mainly comprised of materials with higher hardness. As long as the hardness of abrasive material is higher than the workpiece, wearing of abrasive material will not occur because the wearing only has to do with hardness. However, people usually mistake the breaking of abrasive material by the workpiece for its wearing. In fact, wearing refers to the friction and debilitating relationship between two objects, and the breaking of abrasive material refers to the destruction of an object as a result of external force collision, which has to do with the intensity of the abrasive material.

Granule refers to the number of meshes per square inch on the screen. The higher granule stands for the smaller screened average granular diameter. There has not been a universal granule standard to be followed domestically and internationally. Each company defines its own granule index and how the granule is indicated. The following table shows the relationship between different standard screens and the average granular diameter.

Granule indirectly represents the size of the granular diameter of abrasive material. When abrasive material has a large granular diameter (small granule), it means that the contact area with the binding agent is large and hence they can withstand a larger grinding force compared to abrasive material with a smaller granular diameter when the binding agent of the same intensity is used. It also means that there is a larger space between abrasive material so that the coolant can penetrate to cool down and remove grinding chips more easily. From this, we know that the smaller a granule, the better its grinding capability. However, a large granular diameter means that the surface roughness is also worse and when it is used in hard and crispy glass materials, it also means a greater external force for glass, which accordingly tends to result in larger breaking spots on the glass.

Hardness in specifications refers to the binding intensity between the binding agent and abrasive material, not the hardness of abrasive material. The intensity of hardness is indicated by the ranking of the alphabet. The smaller the alphabet (A), the softer it gets and vice versa. With an over-high hardness, abrasive material tend to shatter without falling, which leads to narrowed space between abrasive material and clogging of grinding chips as well as difficulty for the coolant to penetrate for cooling, among other problems. On the other hand, with an over-low hardness, abrasive material tend to fall easily, resulting in over wearing of sand wheel, which will cause its quick deformation and eventually undermine grinding quality.

The concentration ratio refers to the looseness or tightness of the internal structures of sand wheel, that the looseness or tightness has to do with the volume ratio among abrasive material, binding agent, and air holes. If divided by the percentage of abrasive material in the volume of sand wheel,

破碎或脫落等現象，而這兩個現象代表著砂輪的磨耗。由此可知，強化玻璃與普通玻璃在加工上，不可用相同規格的刀具，或是使用相同的加工條件進行加工，而對於強化玻璃，應選擇強度較強的磨料及硬度高的砂輪，或是降低加工磨削力，才能與普通玻璃維持相同品質。

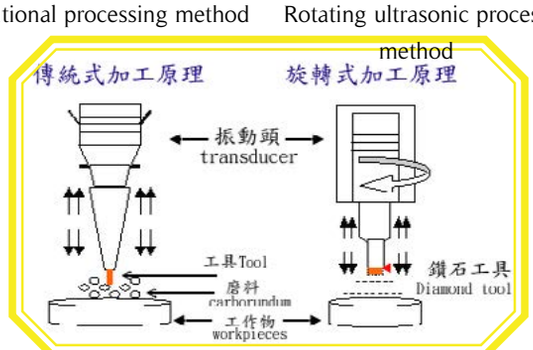
強化玻璃又稱安全玻璃，因表面壓縮力之關係，在研磨時，表面破碎點會比普通玻璃來得小。

集中度 Concentration Ratio	25	50	75	100	125	150	175
cts/cm³(1cts=0.2g)	1.1	2.2	3.3	4.4	5.5	6.6	7.7
磨料比例% Carborundum Ratio%	6.25	12.5	18.75	25	31.25	37.5	43.75

超音波加工

超音波加工之發展，主要是應用於硬、脆性材料的加工，以及提高硬、脆性材料的加工效率。傳統式超音波加工原理，是利用浸在磨料漿中的工具，以高頻率振盪（20kHz 以上）使工具高速的往復運動，驅使磨料漿中的磨料通過微小的間隙去撞擊工件，磨料的撞擊是去除工件材料的主要能量。旋轉式超音波加工，使用刀具與工件接觸以進行切削，這點與傳統式的磨料加工不同。旋轉式雖然不用磨料漿體，但是需要使用冷卻液進行冷卻及排屑。其所使用的鑽石刀具以高速迴轉，作為磨削的功用，並同樣以高頻率振盪來提升鑽石刀具與工作物的撞擊次數，而高頻率振盪所產生的振幅，也同時幫助冷卻液更加容易進入鑽石刀具與工件間的縫隙。冷卻液方面的使用，也可以使用超音波噴嘴或是二流體噴嘴，將冷卻液霧化，使得冷卻液更加容易進入鑽石刀具與工件間的縫隙，進行冷卻及排屑。

Traditional processing method　Rotating ultrasonic processing method



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25% of abrasive material equals to a concentration ratio of 100; also, 0.88g (4.4cts, 1cts=0.2g) of abrasive material in a volume of 1 cm3 equals a concentration ratio of 100. The greater the concentration ratio, the more intense the abrasive material and the space between abrasive material is narrower, too. The following table shows the relationship between abrasive material contents and different concentration ratios.

Glass

Tempered glass is glass with a compressed surface. Once shattered, the glass breaks into small granules and will not cause harm to people, therefore, it is a kind of safety glass. To compress the surface of glass, there are two methods, rapid cooling and ion exchange. The ion exchange method can be used to temper thinner glass while rapid cooling is an easier method to temper thicker glass. Chemical tempered glass is exactly manufactured with the ion exchange method. The intensity of tempered glass increases by approximately five fold.

Tempering only increases the intensity of glass, not the hardness of glass. Therefore, tempered glass will generate a greater grinding force for sand wheel and lead to shattering or falling of abrasive material. These two phenomena indicate the wearing of sand wheel. From this, we know that cutting tools of the same specifications or the same processing conditions cannot be used in the processing of tempered glass and ordinary glass. For tempered glass, abrasive material with a higher intensity and sand wheel with higher hardness shall be used or the processing grinding force shall be reduced to produce the same quality as ordinary glass.

Tempered glass is also known as safety glass. Due to the surface compression, when grinding, the surface shattered spots will be smaller than that of ordinary glass.

Ultrasonic Processing

The development of ultrasonic processing is mainly applied to the processing of hard and crispy materials, and to enhance its efficiency. Traditional ultrasonic processing used high-frequency oscillation (over 20kHz) to enable the tools immersed in the abrasive agent to move back and forth at a high speed, driving abrasive agent through the tiny space and collide with the workpiece. Collision from abrasive material produces the main energy to remove work piece material.

Rotating ultrasonic processing enables the cutting tools to contact and cut the workpiece, which is different from the traditional abrasive material processing. Although there is no abrasive agent used in the rotating ultrasonic processing, coolants are needed for cooling and chip removal. The diamond tool spins at a high speed to cut the workpiece and also uses high-frequency oscillation to increase the times of the diamond tool collides with the workpiece. The amplitude produced through high-frequency oscillation also helps the coolant to penetrate through the space between the diamond tool and the work piece more easily.

When coolants are used, the ultrasonic nozzle or the binary liquid nozzle can be used, too, to gasify coolants and enable the coolants to penetrate through the space between the diamond tool and the workpiece more easily to cool down and remove chips.

門板參數式設計介紹

The Introduction of Parametric Design

李琬琪 Claudine Lee from AIC

參數式設計概念

要介紹參數式設計，免不了要先回顧一下 CAD CAM 發展的由來。話說電腦輔助設計系統（CAD systems）發展起於 1970 年代的 2D 繪圖軟體、1980 年代的 3D 表面建模與實體建模（Surface and Solid Modeling）軟體，這些早期的數位設計工具主要讓使用者在笛卡兒空間座標系統中（Cartesian Coordinate System）直接繪製幾何形體，以視覺化模擬傳統圖面與模型的表現和構成方式為邏輯，然而自 80 年代後期從非制式理性貝茲曲線（Non-Uniform Rational B-spline, NURBS）到參數式模型（Parametric Modeling）軟體的相繼出現，一種以非線性與關聯化的幾何建構方法逐漸成型，並衍生出許多複雜的設計、技巧與應用。而電腦輔助製造工具電腦數值控制銑床（Computer Numeric Control Milling Machine, 簡稱 CNC）的產生，更是將設計概念和生產方式全面革新。

什麼是『參數式設計』呢？

顧名思義參數式設計就是透過定義參數規則與關聯過程做為設計基礎，有別於傳統設計習慣於根據特定設計條件，透過經驗直接決定設計的形式，參數式設計乃是藉由動態地控制影響設計的參數關聯因子，來即時產生、調整設計之幾何形式的設計方法，而其最大的潛力在於運用電腦能即時處理大量重複的資料運算以及屬性關聯，大大的縮短產品設計時程。

可數字化的資訊都可以被轉化為設計的參數條件

簡單來說，使用參數式製圖，你可以將關聯加入至 2D 幾何圖形，關聯是決定物件相互之間的位置及其標註的規則。關聯通常用於專案的設計階段，對一個物件進行變更時會調整其他物件。例如，

Parametric Design Concept

AS to introducing the parametric design, it is inevitable to review the origin of the development of CAD CAM first. The development of computer-aided design systems (CAD systems) started from the 2D graphic software in the 1970s, and also from the 3D Surface and Solid Modeling software in the 1980s. These early digital design tools were mainly used to let users draw geometric shapes directly in Cartesian Coordinate System, with the logic of visually simulated the model performance and construction form of traditional graphics . However, since the late 80s, from the continuous appearance of non-uniform rational B-spline (NURBS) to parametric modeling software, a geometric construction method of non-linearization and association were gradually formed, and a number of complex designs, techniques and applications were therefore derived. The appearance of Computer Numeric Control Milling Machine (CNC) as a computer-aided manufacturing tool even changed the whole design concept and production method.

What Is " Parametric Design"?

As implied by name, the design is based on the defining of the parameter setting rules and the associative process, and it is quite different from the traditional design which is always based on some specific design conditions, that the design form is determined by the experiences directly. Parametric design is a design method which used for immediate generation and adjustment of the designed geometric shapes by means of dynamically control on the design-affecting parameter correlation factors. Its greatest potential benefit is that using computers can immediately handle a large number of repeated data operations and associated attributes, and it

如果一條直線被關聯為與一條弧相切，則弧的尺寸、位置變更時，仍會保持直線與弧相切。參數式製圖在詳細圖面會因設計變更，而需要重新繪製細部零件，使用者可以將幾何物件關聯在一起，或是指定固定位置或角度，也可以使用在對稱的平面設計，這樣就不用花時間修改兩次。

門板參數式設計介紹

以下為 Campro 的參數式設計介面，我們將介面分為五大區塊，在此做一個簡易說明。

定義物件名稱及套用加工型態(如圖1)

使用者可以透過四個選項(手動繪製、從圖面選取、複製、從圖庫選擇)來選擇繪圖方式。

手動繪製(Manual)：使用者依照設計，將圖元依序輸入。

從圖面選取(Select)：從Campro介面選擇所要編輯的圖元，即使客戶已經有非Campro產生的舊圖檔，透過DXF檔案的讀取，我們也可以將客戶既有的圖形資料轉換為Campro的參數式。

複製(Copy)：從已經定義的物件(Group)中複製。

從圖庫選擇(Template)：從既有的圖庫找出符合的形式。

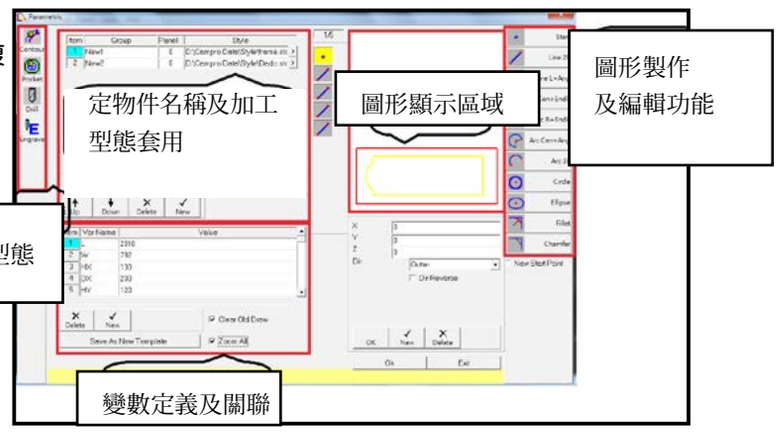
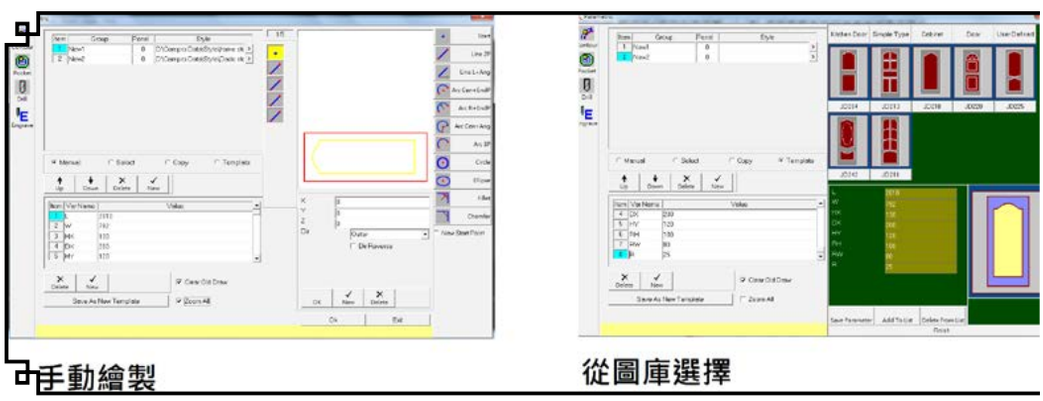


圖 1 (Figure 1)

圖形製作及編輯

無論用什麼方法將圖元載入，使用者在起始位置都可設定加工方向及深度。介面提供了作圖及編輯的工具列，並且允許使用新起點。



變 數 定 義及關聯

由以上程序完成圖形的建立，再藉由定義變數，編輯其關聯來達到客戶需求。經過編輯後的每一張圖都可儲存成使用者的自訂資料庫，建立後的資料庫就有如量身定做般，其好處是精簡，不需要掛一堆用不到的模組。

圖形即時顯示

無論新增或修改編輯，輕點一下顯示區，圖形便會即時更新並顯示。

can greatly shorten the period of the product design process.

Any Digitized Information can be Translated into Design Parameter Condition

In short, by means of parametric design, you can add the linkage to the 2D geometry, which is the rule to determine the location between correlative objects and its annotation. The linkages are commonly used in the design stage of one project, and it will adjust other objects when modifying one object. For example, if a line has been linked as a tangent to an arc, it will remain a straight line tangent to the arc even after some modification of the arc size or location. Parametric plotting needs to re-draw the small parts on the detail plot when there is design modification. Users can set the geometric objects together as a linkage, or specify a fixed location or angle. They can also apply it in a symmetrical graphic design to prevent from spending more time on modifying twice.

Parametric Door Design Introduction

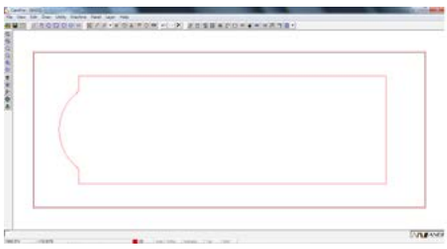
The following is the interface of Campro

加工型態設定

設定加工參數，並且儲存成加工型態。透過加工型態的套用，我們可以將加工的路徑自動轉出。在參數式介面中，我們支援四種加工型態如尋循邊銑、袋、鑽孔、雕刻。

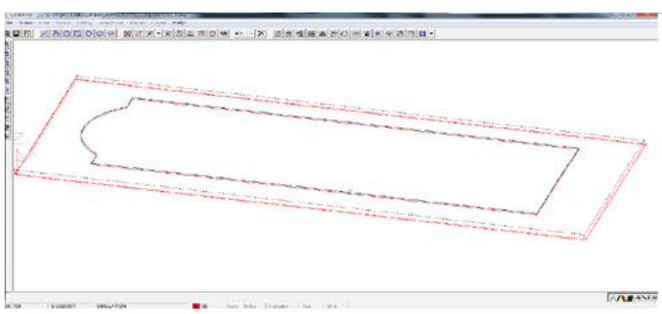
透過變動的設計條件輸入，直接轉換為視覺化的形態輸出，讓設計者可以即時評估與調整。配合 POST，將加工程式轉出並以模擬檢視。

門板參數式設計的應用



Campro 發展 2D 參數式設計至今已有三年，從邏輯推演、程式撰寫到收集資料庫。雖然 Campro 是一個通用型的 CAD /CAM 軟體，但目前其參數式功能大部份仍然被應用於廚櫃門板、門等木工產業，我們透過幫助客戶模組撰寫，吸收經驗、收集資料，建立屬於 Campro 系統的參數式資料庫。

以門為例，客戶編寫基本的參數式模組，配合不同的尺寸或加工型態，一個模組可以衍生出多種不同的設計，不但



以3D模擬顯示加工的路徑並輸出NC程式

縮短產品設計時程，且模組可以重複運用，在分秒必爭的今天，實為王道。

以廚櫃門板為例，因板面變化較多，客戶需要撰寫的型式也會較多，但是一旦建立起資料庫，則可以反覆運用，事半功倍。

參數式設計未來的發展

由於直覺化設計思維已受到主流工程繪圖軟體界的關切，傳統參數式建模 (parametric modeling)，之所以廣泛用於工程、機構的設計，是因為透過 3D 參數式實體曲面軟體系統之參數設定可提供設計師對曲面、凹洞、角度等的精準掌控。各家主要 CAD/CAM 繪圖軟體，包括 Pro/E、SolidWork、CATIA、和 Inventor 等供應商除了提供技術支援之外，還經

parametric door design; we will divide this interface into five blocks and make a simple introductionhere.

Define the Object's Name and Apply the Processing Type

Users can select the plot method with four options (Manual, Select, Copy, Template). Manual: The users input the primitives sequentially according to their design.

Select: With the Campro interface, select the primitive that you want to edit. Even if the customer already has an old non-Campro file, we can transfer the customer's existing data into the Campro parameters by reading of the DXF file.

Copy: Copy from the defined group.

Template: Find a consistent form from the existing templates.

Graphic Plottingand Editing

Whatever method has been used to import the primitives, users can set the machining direction and depth at the initial position. The user interface provides a toolbar for plotting and editing, and the use of a new start point is allowed.

Definitions and the Linkage of Variables

Then, by the definition of variables, the linkages could be edited to meet the customer's requirements. After editing, each plot can be saved as a customized database for the user, that the established database is just like a tailor-made. The advantage is streamlining, which means that it is no need to plug-in a bunch of needless modules.

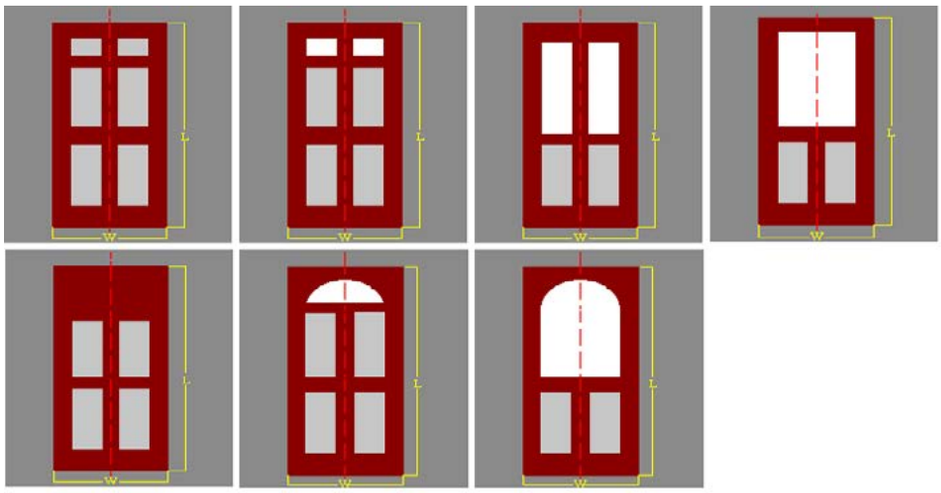
Immediate Display of the Graphics

No matter adding or editing, graphics will be updated and displayed immediately after clicking on the display region.

Machining Style Setting

Set the machining parameters, and save them in the machining style. By applying the style, we can automatically generate the tool path of the maching. In the parametric interface, we support four kinds of machining type, such as contouring, pocketing, drilling, and engraving.

With the input of the modified design conditions, the



常開設很多祕技課程教導使用者做出各種效果。環顧目前市場，參數式設計在今日儼然成為 CAD/CAM 系統不可或缺的標準軟體功能。

正因為參數式設計概念如此廣泛的被應用，今年初，CAD 界的巨人 AutoCAD 2010 也把 2D 參數式整合進來了。而在木工應用上，Biesse 更將各種參數模組包裝成不同的產品，例如 Biesse Door、Biesse Window 等等。檢視國外軟體工業，由於發展的早，在技術上有了一定的累積，在面對更大規模、更複雜的工業應用需求時，我們的能力和他們還存在一定的差距。並且，在人員的編制規模上也相對的都比較小。然而我們有來自客戶端的意見回饋當資源，因此我們每一個新功能的開發都朝著貼近客戶的需求為理念邁進。

目前 Campro 多應用於木工產業，有鑒於一般市面上所使用的設計軟體成本高昂且配合不易，而木工產品如此多元，我們可以朝向建立更專業的參數模組為目標，譬如：

建立廚櫃櫃身的參數式模組並跟排版功能整合。

建立循邊之自定外型參數模組，達到類曲面的功能。

參數式設計應用的範圍很廣，可以發展的方向太多，我只能例舉一二，縱使前面已有巨人擋路，仍然希望可以追趕超越，希望有朝一日，當客戶問起應用軟體時，都會想到恩德。

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CAD/CAM 軟體往直覺化設計靠攏

http://www.zdnet.com.tw/enterprise/column/zdnote

visual form output is directly transformed, which allowed designers to assess and adjust it immediately.

With POST, the processing program can be generated for simulation checking.

Applications of the Parametric Design

Campro has been developing the 2D parametric design for three years, which includes logical deduction, program coding, and database collection. Although the Campro is a generic CAD / CAM software, most of the parametric functions are still being used in kitchen cabinet doors, doors and other woodworking industries. By helping our customers to write modules, we gained experiences and collected data to establish the parameters database which belongs to Campro system.

Take "doors" for example, customers had developed the basic parametric modules, but a variety of different designs could be derived by a single module with different sizes or process types. Not only the product design process is shortened, but also the module can be used repeatedly. In this every-second-count time, it is indeed important.

As to the "kitchen cabinet doors", the modules that the customer needs to write is more because of the variety of the door plate, but once the database was set up, it can be used over and over again which get twice the result with half the effort.

Future Development of Parametric Design

The intuitive design thinking has been cared by the mainstream of the graphic engineering software industry. The reason why traditional

parametric modeling is widely used in the design of construction and mechanism is because it can provide precise control of surface, pit, and angle etc. to the designers by the parameter setting of 3D parametric solid surface in the software system. Other major CAD / CAM drawing software, including manufacturers such as Pro / E, SolidWork, CATIA, and Inventor, that they often open many special courses in order to teach the user how to make a variety of effects, in addition to providing them with technical supports. For the current market, the parametric design has become an indispensable standard software function of CAD/CAM system now.

It is precisely because the parametric design concept has been applied in a wide range of applications, in the early period of this year, the CAD industry giant, AutoCAD 2010, also had the 2D parametric method integrated. In the woodworking applications, Biesse even packed different kinds of parametric modules into different products such as Biesse Door, Biesse Window and so on. By reviewing the foreign software industry, we know that there is still a gap between our ability and theirs when facing industrial application requirement with larger scale and more complexity due to their early development and the certain accumulation of technology. Moreover, our staffing scale is also relatively small. However, we have feedbacks from the customers as resources, so that each development of our new features is based on the philosophy of moving closer to the customers' requirements.

Campro is usually applied in the woodworking industry currently. Knowing that the design software on the market usually have high costs and co-ordination difficulties, and the wood products has such a high variety, we can aim on building more professional parametric modules, such as:

Establish the parametric modules for kitchen cabinet bodies and make them integrated with the layout function.

Establish the customized shape parametric module of through the edge to achieve the surface-like function. Parametric design has a wide range of applications, and can be developed with many directions. I can only cite one or two here. Even with giants standing in our way, I still hope to catch up with them. I also hope that someday users will think of Anderson when they mentioned application software.

References

工業壓電噴墨印表機(IIJ)介紹與軟硬體設計

Introduction of Industrial Piezoelectric Ink jet Printer (IIJ) and Its Software and Hardware Design

翔德光電　賴志一、 劉致奚、莊真英
Chih-Yi Lai, Kai Liu, Chun-Ying, Cheng from DPC

ChihYi.Lai@thinkfly.com.tw
Kai liu@thinkfly.com.tw
Bonny.cheng@thinkfly.com.tw

● 前言

噴墨列印工業，目前在市場上愈來愈蓬勃發展，除了一般事務及家庭紙張、相片的噴印之外，戶外的大型看板、標誌，以及紡織等民生圖像工業也都有其大量應用的場合出現。現在更擴大應用到了高精密的科技領域中，如 FLAT PANEL 顯示器 (FPD) 產業，PCB 產業等光電應用領域之外，其他如生命科學，化學等領域也相繼有新的應用案例產生。顯示其未來發展領域寬闊，市場前景看好。

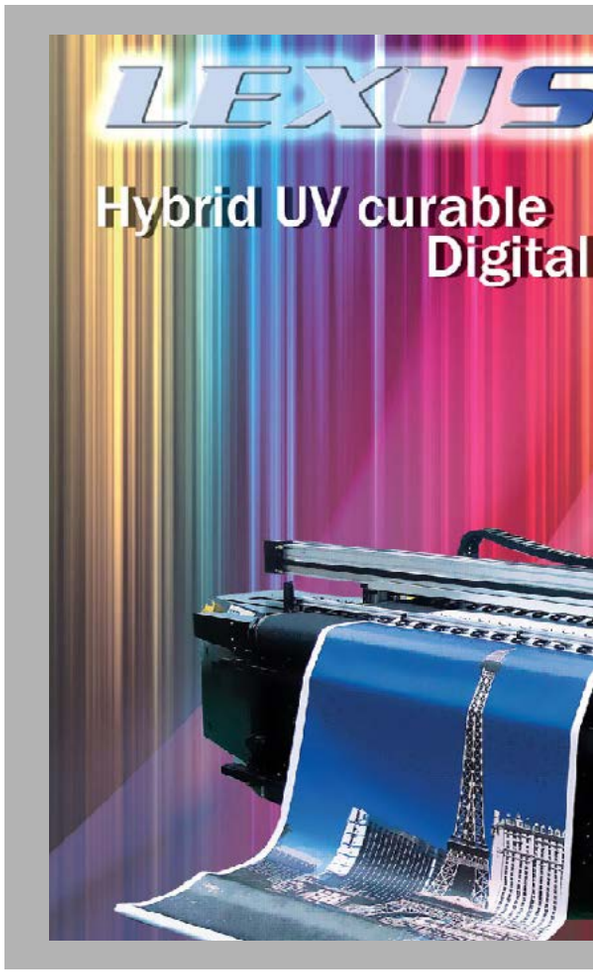
● 市場狀況

噴墨技術的應用以墨水技術區分為三個最主要類別，分別是 Aqueous（水性），Solvent（溶劑）以及 UV Inkjet Printer，其中 Aqueous(HP、EPSON 等）（除 textile printer) 跟 Solvent 均已成為成熟市場 雖具龐大市場商機，卻已有太多廠商占據市廠，而 UV 起步不久（~十年），雖然機器及耗材成本較高，但其應用多且無污染的優點，可預期將成市場之明日之星。

另外由噴墨頭的技術來區分目前市場上主要的兩種噴頭：一為傳統商業噴墨方式，其採用熱泡式 (Thermal bubble) 高溫氣化之運作原理，使得適用液體（主要是水）之選擇性低，因而在工業應用之領域有限。另外一種方式為採用壓電材料特性的壓電式 (Piezo)-electric) 噴頭，其根據結構設計上的不同又可分為 Bend Mode、Push Mode 及 Shear Mode（代表噴頭廠商 Dimatix、Xaar、Konica Minolta) 等方式，而目前又以 Shear Mode 為主流，由於其具有快速、精確且達到所謂的 Drop On Demand 等優點，目前是未來許多工業領域應用的熱門選擇方式。

● Introduction

The ink jet printing industry is a rising star on the market recently. Besides the printing of general affairs, household paper and pictures, its application also reached outdoor large billboards and signs, and daily necessities graphics industries, such as textiles, which also appeared with a large number of application. Right now, it has also been widely used in the technology field with high precision, such as photonic fields like the flat panel display (FPD) industry and PCB industry, etc., as well as life science and chemistry also have new cases appeared successively. All of these show that it is an industry with broad developing space and a promising future.



● Market Update

Based on the ink technology, ink jet printing is mainly divided into three categories, namely aqueous, solvent, and UV ink jet printers. The market of aqueous (HP, EPSON, etc. excluding textile printer) printers and solvent printers had been a mature one. Despite the enormous business opportunities, there are already too many manufacturers securing a share on the market. On the other hand, UV printers are new on the market (less than ten years old). Although the machine and its consumables are more costly, its diversified

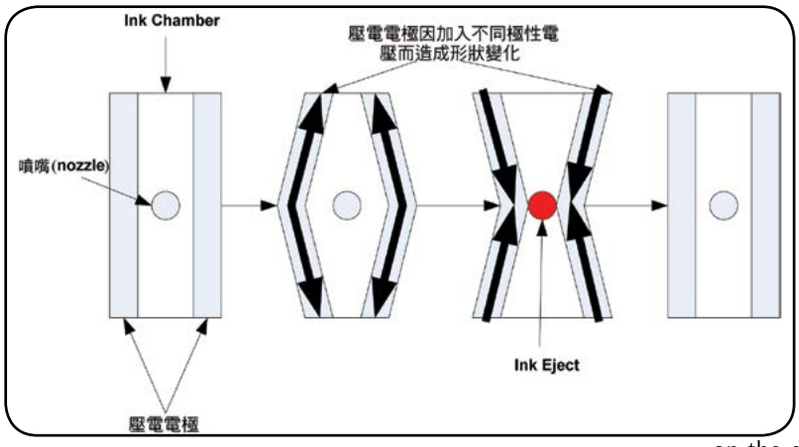


圖1 壓電式Shear Mode噴墨示意圖

Figure 1.Piezoelectric Shear Mode Ink Jet Illustration

目前國內廠商在熱泡式噴墨頭的開發和應用上，已經能自行開發噴頭、墨水等關鍵零組件，另外商業噴墨噴畫及紡織工業上已經有廠商在進行。但在壓電式工業應用方面尤其是 FPD 光電產業目前國內只有少數研發單位及廠商投入進行中，因此著重介紹此一壓電式噴墨核心技術，並進而建立提升產業應用技術能力。

● 技術及功能

在噴墨設備之關鍵控制模組及技術方面，除噴墨頭及墨水之外，就技術面而言，屬於精密機械與控制技術之延伸。噴墨技術具有高速運作、安靜、非接觸作用與可電腦程式化控制的好處，並且製程簡單，不需要光罩以及節省材料，成本較低且更環保等優良特性，因此非常適合搭配不同墨水特性作為各種工業應用的開發。

整個噴墨系統包含了幾個主要的次系統組成元素（參考圖 3 噴墨系統組成圖），噴墨頭 (Print Head)、墨水 (Ink)、墨水供應系統 (Ink Supply System)、移動平台 (Print Table)、噴墨頭清理維護系統 (Service Station)、噴墨控制系統 (Control System)、RIP(Raster Image Processor) 圖像處理軟體，另外針對不同應用領域還有 UV Curing 系統以及機械影像視覺、量測、檢查等附屬系統。而在整個系統中噴墨頭、RIP 軟體方面、UV 光源方面皆已經有非常成熟的產品，而墨水則屬於基礎材料和

application and the advantage of zero pollution have raised the expectation that UV ink jet printers will gain prominence on the market in the near future.

In addition, in terms of the print head technology, there are two kinds of print head available on the current market. One is the traditional commercial print head, which operates on the principle of thermal bubble gasification at a high temperature with minimized options of applicable liquids (mainly water). As such, its application in the industry is limited. The other one is the piezoelectric print head which operates according to the characteristics of piezoelectric materials. Based on the different structural designs, such print heads can be further divided into the Bend Mode, the Push Mode, and the Shear Mode (representative manufacturers are Dimatix, Xaar and Konica Minolta). At present, Shear Mode is the mainstream. Its strengths include rapidness, precision, and the so-called Drop On Demand. It is a popular choice not only in recent market, but will also be applied to many industrial fields in the future.

At present, domestic manufacturers have been able to develop their own key parts and components such as print head and ink, in terms of the development and application of thermal bubble-type print head.

In addition, there are manufacturers been devoted to commercial ink jet printing, painting and the

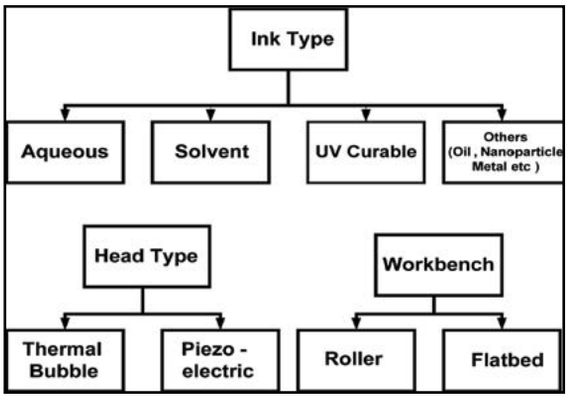


圖 2 噴墨印表機常用種類區分

Figure 2 Common Categories of Ink Jet Printers

textile industry. However, when it comes to industrial application of piezoelectric ink jet printers, especially in the FPD photonic industry, only a few R&D institutions and manufacturers were devoted. Therefore, the introduction will be focused on the core technology of piezoelectric ink jet printing. Further, to establish and enhance the capability of technology application of the industries.

● Technology and Function

In terms of the key control module and technology of the ink jet equipment, besides the print head and

化學領域，且也有多家廠商投入及資源。因此要在此種環境發展噴墨系統，且要能達到高品質和高效率唯有在整個噴墨控制系統中發揮最高的效率和彈性才能達到各方面的需求。

目前筆者們在整個系統架構設計如圖 4 所示：在嵌入式控制器 (Embedded Controller) 方面採用工業用 Embedded x86 PC 主板為硬體平台 + Microsoft 公司所推出的 Win CE 作業系統作為上層軟體核心開發平台，另外自行開發資料和運動控制模組以及噴墨頭控制模組控制板做為硬體核心單元，整個上到下一個硬體架構圖如圖 4 所示，將就幾個重要部份進行說明。

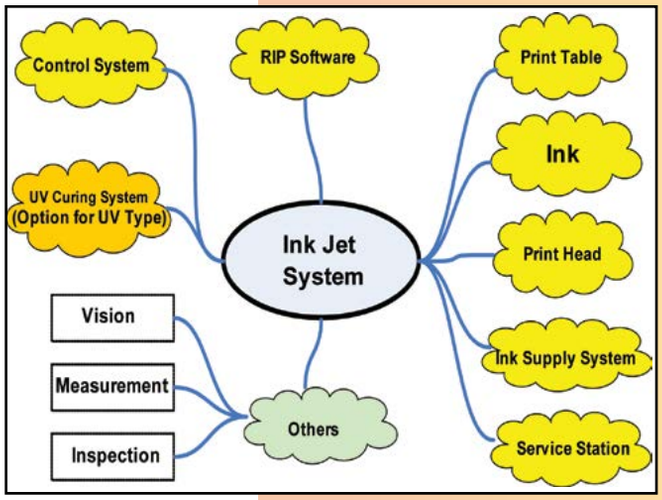


圖 3. 噴墨系統組成圖
Figure 3 .Configuration of An Ink Jet System

● 控制單元介紹：

1. 嵌入式控制器(Embedded Controller)：

採用工業用 Embedded X86 PC 主板 + Win CE 作業系統為軟體核心開發平台且使用 Embedded VC++ 為開發工具。為了得到視窗系統的便利性以及系統硬體資源能控制在一定的範圍內，因此採用 Microsoft 公司所開發的 Win CE 嵌入式作業系統。且由於國內 PC 產業發達因此捨棄自行開發主板的方式而選擇 Embedded X86 PC 主機板來做為核心，不僅價格和種類以及資源上皆能有多樣的選擇，加快開發的速度。

整個嵌入式控制器內部系統架構如圖 5 所示，主要分為人機介面模組，Raster 影像資料處理及噴印資料處理模組，以及，運動控制模組，Media 控制模組，維護模組等軟體處理層。另外還包含資料轉置傳送硬體模組以及通訊硬體實體層。

2. 資料和運動控制模組板：

由於整個系統資源有限，且平台移動速度品質好壞將會影響列印品質。因此將運動控制模組及影像資料轉換傳輸功能整合在一張控制卡上，才能精確的做好移動及列印的同步控制。另外也提供序列傳輸的功能來擴充 I/O 功能及資料除錯設定等功能。

目前在運動控制上透過 DSP 及 FPGA 的硬體架構，採用了 4 軸 DDA(Digital differential Analyzer) 數位積分的運算方式，提供 Pulse-Type 的 Motion 控制，另外也有 2 軸 Velocity-Type 或直接 PWM 輸出的運動控制架構，提供不同種類馬達的控制架構。並且由於工業列印機台跨距大（高達 2~3 米長），因此支援雙軸馬達同時驅動單軸的運算功能。

而且由於影像資料需要快速的處理和轉換，因此在和上層溝通介面上採用了 PCI-33Mhz 的傳輸界面，運用 32 位元高速的傳輸效率來作為影像圖檔的傳輸，提高多噴墨頭列印速度。然後資料經過 FPGA 以及 DSP 的運算處理再轉換為高

the ink, the technical performance is the extension of precision machinery and control technology. Ink jet technology features advantages such as high-speed operation, quiet, contact-less and computer programmable control, and with a simple process. It does not need a light shield and can save on materials, which accordingly cuts down the costs and makes the product more environmentally-friendly. When used with different inks with distinctive characteristics, it is an ideal choice in the development of various industrial applications.

The whole ink jet system encompasses several important sub-system components(Figure3): the print head, the ink, the ink supply system, the print table, the service station, the control system, and the raster image processor (RIP) software. Further, for different application fields, there are additional UV curing system and auxiliary systems such as machinery image visualization, measurement, and examination. For the whole system, the field of print head, RIP software and UV light source had already existed very mature products. Ink is an essential material and falls in the chemistry field, in which many manufacturers had invested resources,

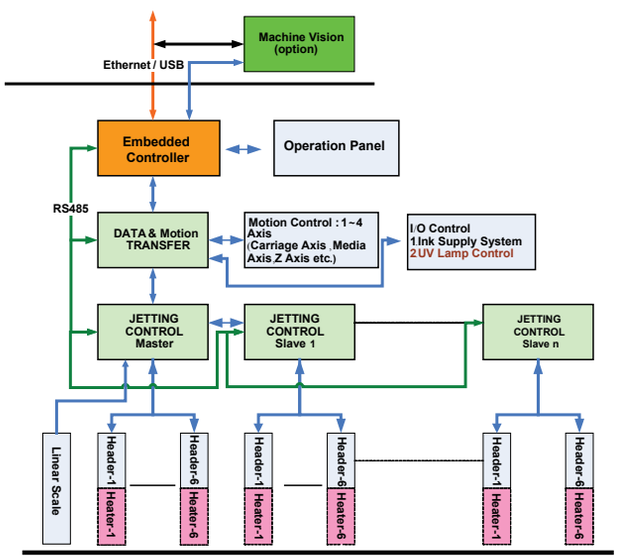


圖4 噴墨控制系統架構圖
Figure 4. Structure of the Ink Jet Control System

速同步序列式的傳輸界面，提供給噴墨控制模組板，再進行資料的轉換，最後經過適當的噴墨時序提供給噴墨頭進行噴墨的動作。

3. 噴墨頭控制模組控制板：

主要是針對噴墨頭進行資料時序的傳遞控制，以及壓電噴嘴電容的電壓控制。另外也包含了溫度控制模組，以根據不同墨水的特性調整噴墨頭的工作溫度。整個噴墨頭控制模組包含了以下幾個主要部份：高電壓產生器，電壓波形控制驅動模組，噴墨資料傳送模組，噴頭時序控制，噴印時機產生控制，以及溫度控制模組。如圖 7 所示。

壓電噴墨頭的控制，一般需要一個可調整的直流高電壓控制迴路，來提供驅動壓電噴嘴能量而將墨水激發。根據不同的噴墨頭形式和驅動架構，電壓高低差異非常大，從 160V~20V 的形式皆有（一般分為三類，70V 以上、20~40V、20V 以下）。另外驅動的波形控制方式也有多種理論架構。有單電壓、雙電壓，固定斜率，固定上昇 / 下降時間等各種波形的控制方式。基本上都是以壓電電容量的充放電的觀點去考量，一般一個噴墨頭的電容值大約在數百 pF 的範圍，因此利用簡單的電容充放電公式：I=C*dV/dt，即可根據反應需求計算出功率大小，再經過噴墨速度的要求即可求出平均功率，來作為電壓供應器大小的設計規格。

另外電壓的大小除了噴頭本身的條件之外還和墨水種類及溫度，噴印速度有關，因此要能得到良好的列印品質，這些條件都需要嚴格的去控制，才能得到穩定精確的結果。

而噴印時機控制也是很重要的一環。包括多組噴頭同步，位置誤差以及正負方向列印的補償，也都是要達到高畫質圖像 Pattern 缺一不可的項目。

●噴墨資料列印流程：

首先設計者在繪圖軟體（如 Photoshop 等）CAD 工作站上設計影像檔案資料。然後將影像貯存在 DATABASE 中，透過 RIP (Raster Image Processor) 分色軟體將影像圖檔解析分色出 Y(Yellow), M(Magenta), C(Cyan), K(Black) 等四基本列印色。最後傳送至噴墨印表機 (Ink Jet Printer)，透過噴墨頭將影像在所希望呈現的媒介上列印成品，完成加工（如圖 8）。

列印資料的處理，主要目的是要將影像資料經過影像分析 (Parser) 模組，將其每個點的色彩組成成分分解成基本的 YMCK 四色色彩，再將其橫向列一條一條的資料組成一個噴墨頭寬度的大小一一傳送給各個噴頭，然後經由線性的位置產生器來決定噴點的位置，一一將每個點噴射在所要成像的媒體材料上。

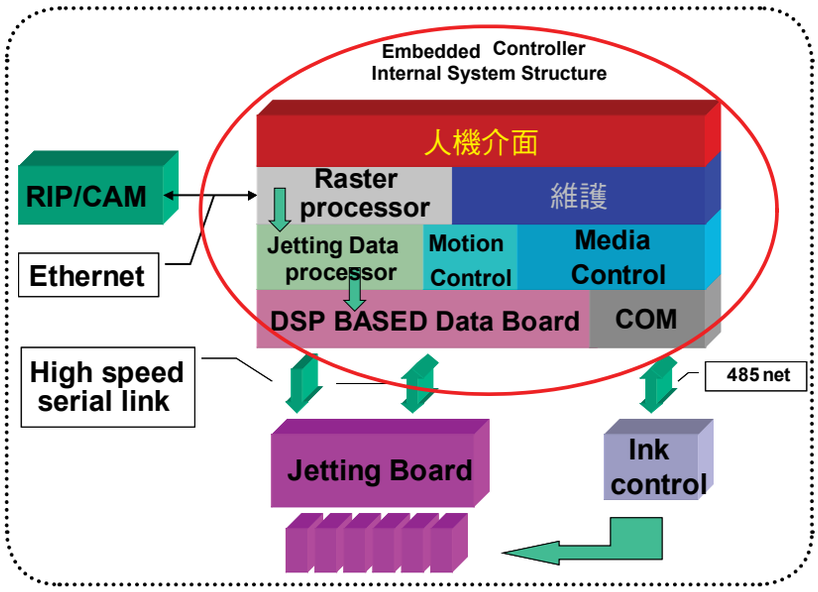


圖 5 .Printing Process Embedded Control Structure 示意圖

Figure 5.Printing Process Embedded Control Structure Illustration

too. Therefore, to develop an ink jet system under this circumstance that features both high quality and high efficiency, the whole ink jet control system must be able to operate with maximum efficiency and flexibility to meet demands of all aspects.

Recently, the structural design of the whole system by the authors is shown in the following figure.(Figure 4) The embedded controller had adopted an industrial embedded x 86PC motherboard as the hardware platform + Microsoft Win CE operating system as the core development platform for the upper level software. In addition, we developed the data and motion control module, and the control panels of the print head control module as the core units of the hardware. The whole hardware structure from top to bottom is shown in the following figure. Description of several important parts will be given below. (Figure 4)

• Introduction of Control Units:

1.Embedded Controller:

The industrial Embedded X 86 PC motherboard + Win CE operating system were adopted as the core development platform for the software, and use Embedded VC ++ as the development tool. In order to have the convenience of the Window system and control the hardware resources of the system within a certain range, we adopted Win CE embedded operating system developed by Microsoft. Moreover, in light of the advanced PC industry in our country, we did not develop our own motherboard but chose the Embedded X86 PC motherboard as the core, which does not only diversify our options in terms of prices, types, and resources, but also expedited the development speed.

The structure of the internal system of the whole

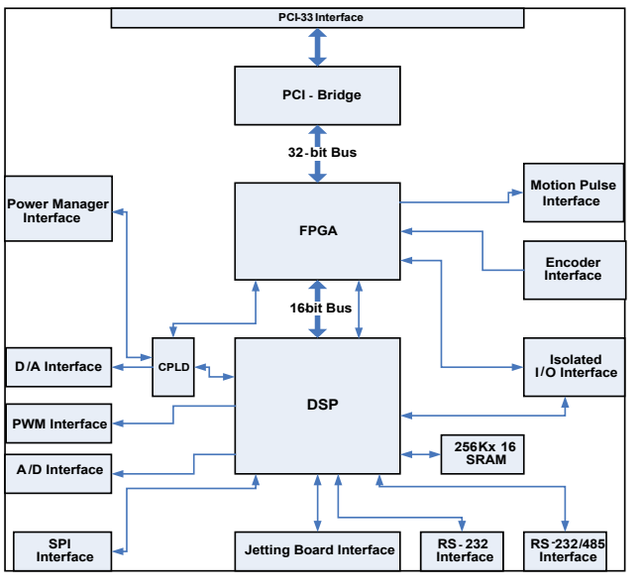


圖6. 資料和運動控制模組架構圖

Figure 6 Structure of the Data and Motion Control Module

看似簡單重複的程序，但是由於要列印的次數很多，因此整個資料傳送的穩定性及高重現性的要求是此一系統設計上最大的考量。底下是上下層資料傳送時序圖（圖 9），透過同步序列協定的快速資料傳遞來達到噴墨自料的傳遞。

● 結論

除了上述所談到部份外，一個噴墨系統還包含了墨水供應系統（Ink Supply System）的設計，牽扯到如何維持穩定的噴墨頭負壓，讓墨水能輕易經由噴墨頭噴射而出，且噴完後能將墨水 suck back 回噴嘴內，而不會有滴墨的現象產生。而噴墨頭清潔維護更換以及噴頭保護的 Service Station（包含刮板 Wiper & 密封盒 Cap）設計以及 Media 材料上下料吸附等硬體系統的考量，也都是需要一一深入探討。另外在噴點的校正，色彩的修正以及噴印速度、位置的補償校正也都是很重要的課題。甚至於高精度高解析度（512 nozzle）以及灰階 Grey-level 噴墨頭也已經問世，不再像傳統 Binary(0/1)，只能以印或不印的二元方式列印，灰階噴墨頭能得到更好的列印品質。

噴墨方式的應用發展愈來愈多元化

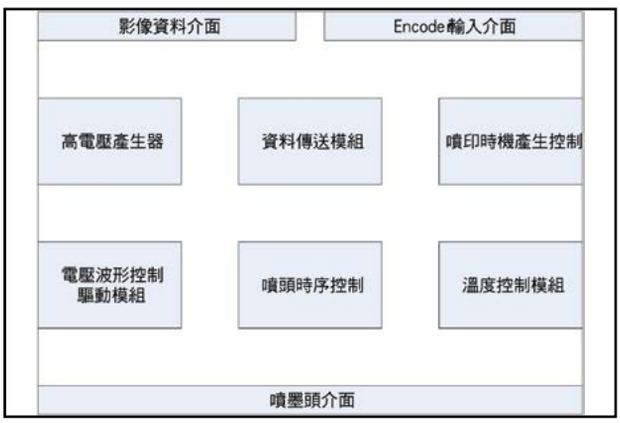


圖7 噴墨頭控制方塊圖

Figure 7 .Block Diagram of Print Head Control

embedded controller is shown in the following figure.(Figure 5) The system is primarily consists of the man-machine interface module, the Raster image data processor, the ink jet data processing module and software processing layers comprised of the motion control module, the media control module, and the maintenance module.

In addition, there are the data transpose transmission hardware module and the physical layer of communication hardware.

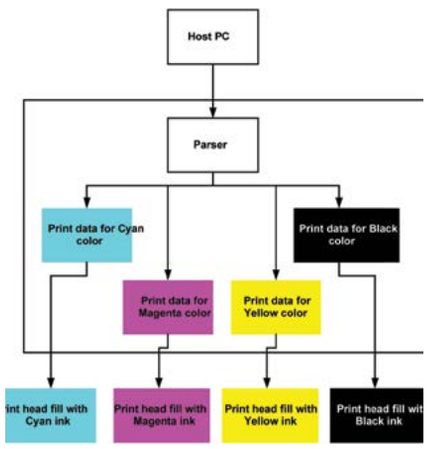


圖8 YMCK 4色資料流程圖

Figure 8YMCK 4-Color Data Process Flow

2.Data and Motion Control Module Panel:

Due to the limited resources of the whole system, and the quality of the platform moving speed will affect the printing quality, therefore, the motion control module and the image data conversion and transmission function are integrated onto a control card, in order to have synchronized control over the movement and printing precisely. In addition, the series transmission function is also provided to expand other functions such as the I/O function and the data debug setting.

Recently, the motion control is done through DSP and FPGA hardware structures. The four-axis DDA (digital differential analyzer) digital accumulation calculation is adopted to provide pulse-type motion control. In addition, there is also the two-axis velocity-type or motion control structure been output from PWM directly as control structures for different types of motor. Moreover, due to the large span (2 to 3 meters long) of industrial printers, the double-axis motor can be supported with the calculation capability of activating single-axis at the same time.

Besides, due to the image data need to be processed and converted rapidly, the PCI-33Mhz transmission interface is adopted as the interface used to communicate with the upper layer. The 32 bytes high-speed transmission efficiency is used in the transmission of image files, and enhanced the printing speed of multi-print head. Then, data will go through calculations and processing by FPGA and DSP before they were converted to the high-speed synchronized series transmission interface, and provided to the ink jet control module panel. Then, data are converted again and finally provided to the print head through proper ink jet timing to initiate the ink jet printing motion.

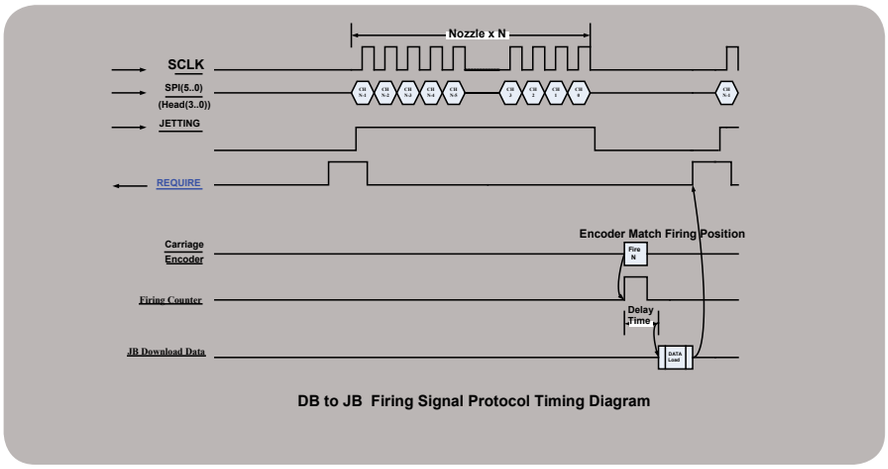


圖9 噴墨資料傳送時序圖

Figure 9 Inkjet Data Transmission Timing Chart

也愈來愈朝高精度高解析度以及更高速的趨勢以及高整合的方向發展。因此一個良好的穩定控制器系統，在整個工業噴墨列印中的角色扮演，越來越重要，也越來越複雜。

另外也由於噴墨應用領域寬廣，如何做好其他週邊（例如機器視覺定位系統，線上列印檢測監控等）整體系統的良好整合，也將是未來產品 開發時需特別注意的地方。

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[6]www.xaar.co.uk

[7]www.dimatix.com

3.Print Head Control Module

Control Panel:

It targets primarily the print head and controls the transmission of data timing and the voltage of the piezoelectric nozzle capacitance. In addition, there is the temperature control module which adjusts the operating temperature of the print head based on characteristics of different inks. The whole print head control module encompasses these primarily parts as shown in the following: the high-voltage generator, the voltage waveform control activation module, the ink jet data transmission module, the print head timing control, the printing timing generation control, and the temperature control module. See the following block diagram.(Figure 7)

Generally, the control of the piezoelectric print head requires one adjustable DC high-voltage control loop which provides the energy needed to activate the piezoelectric nozzle and stimulate the ink. Based on different types of print head and activation structure, the voltage fluctuates drastically between 160V and 20V (generally divided into three categories, those over 70V, those between 20 and 40V, and those below 20V). In addition, there are many theoretical structures in terms of the control methods of the activating waveform. There is the single voltage, the double voltage, the fixed slope, and the fixed ascending/descending time, among other waveform control methods. Basically, all are considered based on the viewpoint of charging and discharging power of the piezoelectric capacitance. Generally speaking, the capacitance of a print head is around several hundreds of pFs. Therefore, with the simple capacitance charging and discharging formula: I=C*dV/dt, one can calculate the power based on the response requirement. More, the average power can be obtained through the demand of ink jet printing speed, which can be the design specifications for the size of the voltage supply.

Besides the conditions of the print head, the voltage magnitude also has to do with the type and temperature of ink and the printing speed. Therefore, to obtain good printing quality and stable and precise results, these requirements must be strictly controlled.

Also, the printing timing control is also important. Including the synchronization of multiple print heads, the compensation for position deviations of the forward and backward printing are all indispensable for a high-quality pattern.

● Ink Jet Data Printing Process Flow:

First, the designer will design the image file data on the CAD workstation of graphics software (e.g. Photoshop). Then, images are saved in the DATABASE. Through RIP (Raster Image Processor) color-spilt software, image files are analyzed and divided based on the four basic printing colors: yellow (Y), magenta (M), cyan (C), and black (K). Finally, images are sent to the ink jet printer and be printed on the intended media through the print head to complete processing.(Figure 8)

Processing of printing data is primarily meant to break down color compositions at each point of the image data through the image analyzer (Parser) module into four basic colors, YMCK, and then combine each piece of horizontal data to the width of a print head, and send them one by one to each print head. After that, the linear position generator is used to determine the spots of injection, then inject each spot onto the media for image forming.

The process seems simple and repetitive, but due to the numerous times of printing, stability and high

reproducibility during the whole data transmission process are the main considered factors in the design of this system. The data transmission timing between the upper and the lower layers are shown below(Figure 9). The transmission of ink jet materials is achieved through rapid data transmission of the synchronized serial line protocol.

• Conclusion

Besides those mentioned above, an ink jet system also includes the ink supply system which involves how to maintain a stable negative pressure of print head, so that ink can be easily injected from the print head and be sucked back to the nozzle after injection without ink drips. The cleaning, maintenance and replacement of the print head, and the design of service station for protecting the print head (including the Wiper and the Cap) as well as hardware systems used for the suction of media while loading and unloading needs to be explored in depth, too. In addition, the calibration of the injection spots, the modification of color resolution, the printing speed, and the compensation and calibration for positions are also very important issues. Moreover, even print head with high-precision and high-resolution (512 nozzle) and Grey-Level have been introduced to the market. Unlike the traditional Binary (0/1) can only printed in print-or-not-print binary mode, grey-level print head can ensure better printing quality.

The application and development of ink jet printing methods are getting more and more diversified, and aim at targets of high-precision, high-resolution, high-speed and high-integration-oriented. Therefore, a control system with good stability will play a more and more important and complex role in industrial ink jet printing. In addition, due to the wide application of ink jet, how to well-integrate other peripherals (e.g. machine visual positioning system, online printing detection and monitoring, etc.) and the overall system is also an issue needs particular attention when developing products in the future.

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黃富盛 Fu-Sheng Huang
FROM AIC

高速主軸拉刀桿防旋機構設計

The Design of High-Speed Spindle Broach Rod Whirl-Prove Mechanism

一、內容說明

隨著光電、電子、通訊、光學、醫療及生物科技等產業的興起，對精密及微小化精細元件之需求日益增加，這些元件具有輕、薄、短、小的特性，在製作上無法以傳統的加工設備加工。在精微加工技術中，以微銑削、微放電及微雷射為技術主流，目前高速銑削的發展，利用高速主軸進行3D加工，以逐漸取代雕模式放電加工，能有效提高製程效率及降低成本。發展高速主軸已為主流趨勢，其中振動量的大小與穩定程度，將影響到加工的品質。

為了能確保主軸振動量穩定，拉刀桿不因吐刀後造成旋轉，設計上採用有防旋的機構設計，將拉刀桿固定於同一位置，能有效確保主軸振動量穩定。

I. Content Description

As the rise of industries like photonics, electronics, communications, optics, medicine, and biotechnology, the demand of delicate and micro fine elements is increasing day by day. These elements are light, thin, short, and tiny and cannot be manufactured by traditional processing equipment. Among the various micro-machining technologies, micro milling, micro electrical discharge, and micro laser are the mainstreams. The recent development of high-speed milling features 3D processing with a high-speed spindle to gradually replacing the casting-type of electrical discharge processing and effectively enhance the efficiency of the process and cut down the costs. The development of high-speed spindle had become the main trend. The oscillation volume and stability will affect processing quality.

To ensure the spindle oscilation is stable, and the pulling rod does not whirl following the release of a tool,the whirl-prove mechansim design will fix the

broach rod to the same position and ensure the spindle oscillation volume to be stable effectively.

Names of each part are shown in Figure 1:

1. Front End of the shaft
2. Shaft
3. Nut
4. Disc Spring
5.Teflon
6.Pulling Rod

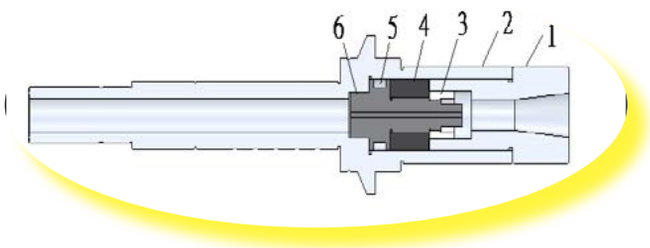
II. Description of Design:

Generally, Pulling rods are designed without the whirl-prove mechanism. When the machine is processing, tools are changed frequently, resulting in angle deviation between the pulling rod and the jaw chuck and adding to the imbalance, which compromised the dynamic balance of the spindle.

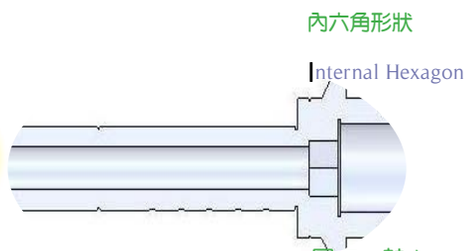
This design features hexagonal binding design in the internal shaft.. The internal hexagon (polygon) is formed through internal electrical discharge

各個零件名稱，如圖一所示：

1.軸心前端
2.軸心
3.螺帽
4.盤型彈簧
5.鐵氟龍
6.拉刀桿



圖一、軸心組防旋機構設計
Figure 1: Design of Shaft Assembly Whirl free Mechani



圖二、軸心
Figure 2. Shaft

二、設計說明：

一般設計拉刀桿時，並沒有設計防旋機構，機器加工時，換刀頻繁，將導致拉刀桿與刀爪頭，產生角度偏移，造成不平衡量變大，影響到主軸動平衡。

此設計採用軸心內部六角接合設計，內部使用放電加工內六角形狀(多邊形)。而拉刀桿設計外六角形狀(多邊形)，組裝時互相結合，如圖二與圖三所示，將拉刀桿固定於同一位置。並使用耐磨耗的鐵氟龍來滑動，減少因打刀時，金屬間摩擦，造成磨損，並使用缺氧膠來接合軸心前端與軸心，外部利用雷射焊接來接合，補強軸心強度，如圖四所示。

重點：

利用內外六角接合，來防止拉刀桿旋轉，控制拉刀桿位於同一方向，打刀時拉刀桿皆為於同一位置，故振動量穩定。

優缺點比較：

優點:

固定拉刀桿避免產生側向旋轉，影響主軸振動量。

缺點:

防旋機構無法更換，若有問題需更換軸心。

三、結論

經過一連串打刀測試 1000 次後，量測結果如圖五所示，主軸振動量差異不大，確實能防止拉刀桿旋轉與振動量穩定，此設計可以廣泛應用在各類軸心上。

processing and the pulling rod is designed with an external hexagon (polygon), that they will be bound to each other during assembly. See Figures 2 and 3. The pulling rod is fixed in one position and conducted gliding through wear-tolerant Teflon to reduce friction between metals which led to wear while unclamping. Moreover, the anoxic gel is used to bind the front end of shaft and shaft itself. Externally, binding is done through laser welding to reinforce the intensity of shaft.. See Figure 4.

Keypoint:

The external and internal hexagons are bound together to prevent whirl of the pulling rod and control the pulling rod in the same orientation. Even during unclamping, the pulling rod is still fixed in the same place. Therefore, the oscillation volume is stable.

Comparison of Strengths and Weaknesses:

Strength:

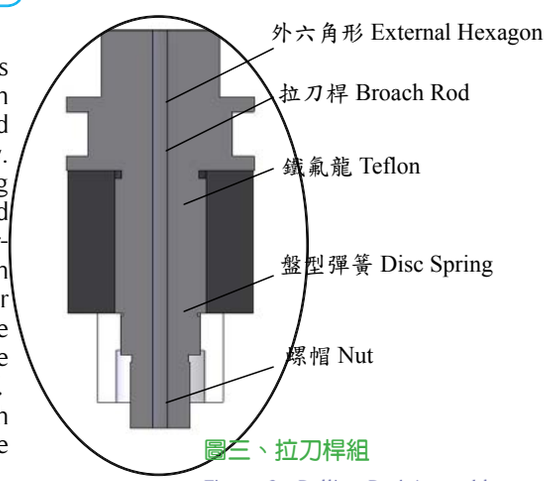
The pulling rod is fixated in one place to avoid lateral whirls which will influence the oscillation amount of the spindle.

Weakness:

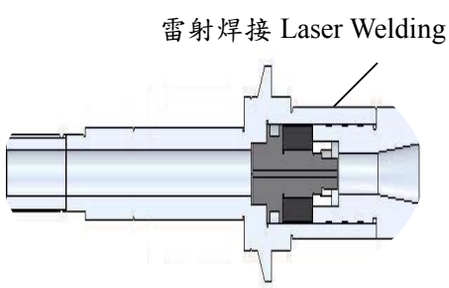
The whirl-prove machanism cannot be replaced. If there is a problem, the shaft needs to be replaced.

III. Conclusion

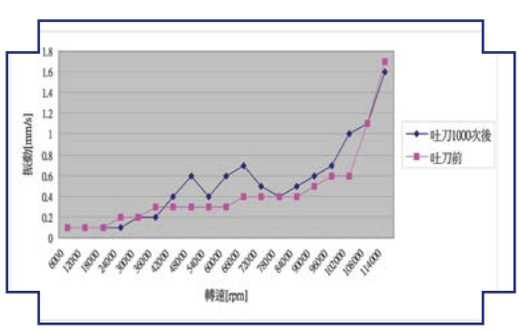
After a series of 1000 times of unclamping tests, results of measurements are shown in Figure 5. The difference in the spindle oscillation amount is little difference, so it can indeed prevent the pullingrod from whirling and maintain the stability of the oscillation. The design can be widely applied in all kinds of spindle.



圖三、拉刀桿組
Figure 3. Pulling Rod Assembly



圖四、軸心組
Figure 4. Shaft Assembly



圖五、吐刀測試
Figure 5. Unclamping Test

GVM雕刻機
高精度CNC刀模雕刻機

GVM Engraving Machine-High-Precision CNC Engraving Machine for shape cutting chipping technology.

Alfred Könemann
from AEC

市場目標

舉凡印刷、標籤與貼紙市場所使用的軟性刀模，無論是使用於印痕、切斷，或各式壓力控制的刀模，此種刀模的應用如紙盒、薄膜、布料等特殊材料的製作。

Target market

The production of flexible dies, which are used by the graphical industry, the supply market of self-adhesive labels, the kiss-cutting and cutting through (down to the anvil) of foils, all kinds of pressure-sensitive composites, thin cardboard boxes and foam foils as well as an array of woven fabrics and special materials require a dedicated production solution.

機械的目的

GVM機械是專門生產滾筒式切斷或印製的軟性刀模，GVM的開發始於1997年，發展至今已成為軟性刀模製造設備的市場領導者。

Machine purpose

Concerning these requirements the GVM Engraving Machine is specifically developed for producing flexible dies for the rotary printing and cutting industry. This typical application is since 1997 worldwide approved by the manufacturing market leaders of flexible dies.

製程概要

為使鉻鐵合金蝕刻的軟性刀模在高速主軸銑削後，得到高品質的水準，需要一個特別的工序與成型方式來控制，以適應生產各式各樣的刀模圖形。GVM機械因能直

接加工出高品質的刀峰，所以不需要切削後的後製程。這與傳統的銑床加工，因刀峰品質差需翻轉刀模，再次研磨背面，反使刀鋒受損，因此減損刀模使用壽命，這些差異使GVM更顯其優勢。

Process overview

By Ferrochlorid etched flexible dies are engraved with a high-speed milling spindle at a consistently high quality level. An individually programmable sequence and contouring control allows the flexible production of various free formed shapes. Thanks to the quality of the cutting edges post-machining of the flexible dies becomes unnecessary - a major advantage compared to conventional milling machines in which the cutting quality and productivity is impaired by the necessary grinding of the bottom face of the die.

情況分析

精密的平面铣床和GVM雕刻機有何區別？ 為什麼不使用一般標準CNC機器來生產軟性刀模？ 我們深知這些問題之所在，所以想發展的GVM雕刻机是：

- 一台專用目的機械，不是為多用途的目的而設計。
- 是專為生產高品質軟性刀模而開發的。
- 可利用Ethernet連結到現有的網路。
- 允許不同刀模產品同時排列加工。
- 利用銑刀尖角角度與直徑，可彈性的生產各式幾何形狀的軟性刀模。
- 非接觸式的量刀系統，可量取加工所需的銑刀長度、刀尖角度、半徑等
- 特殊的主軸設計，防止加工軟性刀模時的熱膨脹，維持刀尖的正確位置。
- GVM提供一個水冷系統來冷卻驅動馬達和高速主軸，以維持溫度的最高穩定度。除此冷卻系統也特別對各軸與機床，提供一完整的溫度控制。

「只是加工切削」是不足與高精度結合的高性能切削相較！這個結合將使它毫無疑問提供給机器操作員決定在「好」和「很好」之間的加工品質。雖然一般人不容易區分，但我们是可以發掘這兩者的差異關係，如數微毫米的精度差異和數千歐元成本的差距等，所以軟性刀模不是只有一種軟性刀模；因此我們必須至少分為2種品質標準; 一種是用於切斷材料上，如標準的紙張和沒有塗料的紙張-固定在厚的襯墊基楚上，建議使用標準刀模，尺寸範圍約300 × 400mm，高度約在4-6微毫米的。

另一類品質的刀模，是切削特殊材料的軟性刀模，如切削已上塗料的紙，或薄膜材料PP-附著在很薄材料上，或是大於400X600mm的大型刀模，這些刀模的設計常常結合複雜的形狀和較長刀鋒圖形，甚至超過50m長的雕刻路徑，這需要花費16小時以上的時間來生產這種軟性刀模。

Situation analyses

What's the difference between a precision flat bed milling machine and the GVM engraving machine? Why not using a common standard CNC machine for producing flexible dies? - These questions are more than known to us, which we like to respond that the GVM Engraving Machine is:

- A specifically developed machine design... not only adapted for multi purpose
- developed for High Quality CNC controlled sharpened flexible dies
- Flexible due to free scalable cutting edge geometries by tool angle and diameter
- Multiple arrangements of different production orders is equally possible
- Integration into existing network structures via Ethernet interface
- The contactless tool measuring system achieve all necessary dynamic tool contour geometries like length, open angle and active tool radius, concerning the job

requirements

- The special design of the milling spindle prevents a negative effect on account of the thermal expansion while maintaining the constant position of the tool tip within the flexible die contour
- The direct drive motors and high-speed cutting spindle of the GVM are water-cooled in order to afford the entire system maximum temperature stability. In addition the cooling system of the drive motors is specifically designed to offer complete thermal encapsulation between the machine axes and the machine base.

"Just machining" won't be enough – High performance chipping combined with highest precision! This joint requirement will make it out of the question to commit the machine operator the decision between a "good" and "a good enough" machined quality.

This really sounds as a hard pronouncement, but will be taken relative due that the gap between these both parties are just a few thousand of a millimeter – and more often a few thousands of Euros product costs. Flexible dies are not just flexible dies at all; herewith we have to separate between minimum 2 quality standards; on one hand and for the purpose of cutting materials, like standard paper and non-coated paper, fixed on thick liners, therefore recommended are standard dies in dimensions of approx. 300 x 400 mm with the requirements of 4-6 microns in total height.

On the other hand there are flexible dies for cutting more critical materials like coated paper or several thin film materials, i.e. polypropylene PP, which are fixed on always thinner liner materials, as well as bigger die dimensions - above 400 x 600 mm. These dies more often combine complex shapes together with increased geometry length; dies above 50 m engraving paths are possible and may take 16 hours and more of production time.

機械概觀

GVM機床是使用含石英成份很低的高品級細緻天然花崗石，此種花崗石能提供機台優越的機械性質，與一般的機台材料相較，這種百萬年的花崗石有更多的優勢。

-高硬度、沒有磁性。

-對於機械振動有更好的阻尼性能。

-耐磨損與高穩定性。

這些花崗石的物理性質提供給機台使用空氣軸承的利基，吻合機台高精度沒有衝擊的定位方式。壓縮空氣為軌道與空氣軸承間的介質，防止兩者的磨擦與確保兩個介面達到零維護的境界。

GVM的進給軸使用線性馬達的技術，直接驅動無需任何傳動機構(如滾珠螺桿、皮帶、齒排、或類似的機構)來傳遞動力。由於好的控制性能與極高精度的定位，所以能優異的達成高速切削的需求(沒有磨耗、強力動力技術、和零維護)

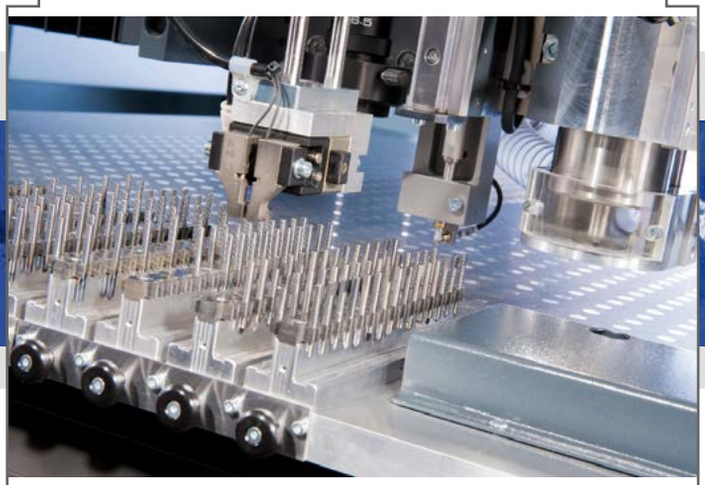
Machine overview:

The machine base used for the GVM is natural granite in a quality of a fine-grained structure with an extremely low content of quartz, which offers excellent mechanical properties. As a million year old material granite offers a lot of advantages comparing to common used materials:

- Outstandingly good damping capacity when subjected to mechanical vibrations
- Extremely high wear-resistance and long-term stability
- Considerably harder than steel, free from magnetic influences

These physical properties of the granite base gives the advantage to use pre-stressed air-bearing

guides to meet the outstanding high requirements in terms of a jerk free and precision positioning as well as the demand for an extremely high availability. The compressed air used as a medium in air-bearing guides prevents all friction and makes virtually maintenance-free working possible.
The feed axes of the GVM feature consistent use of linear direct drive technology. Direct drives do not need any mechanical transmission elements (such as ball screws, toothed belts, toothed racks or similar devices.) along the force route. As a result, they lend themselves especially well to really high-speed cutting processes (no wearing parts, robust motor technology and no maintenance), due to an excellent control performance and extremely good positioning behavior.



重要的功能

iHOC系統(最佳高度切削整合系統)提供彈性確實的維持刀模底部到刀鋒的高度，利用參數的設定與品質標準的定義，本系統可以在加工過程中，監督並維持製程的最佳化。機台檯面以花崗石構成，配合手工製作成絕對水平檯面，檯面上有無數的微小真空孔道，連結真空系統來固定軟性刀模。花崗石檯面的重量和特殊的軌道成為平衡機械振動的最佳阻尼，是GVM設備要達成高精高品質加工最重要零件之一

Outstanding Key Functions

The iHOC system (integrated Height Optimized Cutting System) flexibly ensures that the preselected flexible die height between the cutting edge and the bottom face of the die is maintained. The observance of preselected parameters and quality standards during the entire machining process is optimized by the adaptive system.

The machine table is made from a solid granite block with an absolutely level, manually verified surface.Secure fixing of the flexible dies on the machining table is achieved via a vacuum system with numerous micro-injectors (adjustable suction capacity). The granite's high proper mass and a special guide system produce an optimum damping behavior to counteract mechanical vibrations as important components of the production process the GVM machining table meets all the requirements in terms of both precision and quality!

CNC的對策

資料庫型式的人機介面，提供彈性、簡易的操作程序，縱使機械已開始加工，但許多加工程序仍然可以被修改或重新定義。一個區域型的資料庫可以被選配，此功能自動將製作完成的程式，同時並安全的儲存到外部伺服機上。一種更靈活的CNC程式語言，提供比DIN66025標準還多的指令，利用這些指令與結構完成的加工程式，宛如使用更高階語言(如IF-THEN-ELSE, GOTO, FOR-WHILE-DO, CASE…..)。完全整合的加工中線上前視功能，配合線性馬達優異性能，縱使在反向的路徑上，也能實現無衝擊的定位。

CNC Strategy

The Human-Machine-Interface of the databases provides a flexible & comfortable operation process. While the manufacturing process is running, a lot of operational procedures can be changed and/or definied.The optional, global data base administration of the CNC-programs stored on an external server system offers a concise and at the same time a secure production flow.The process of so called "continuous" CNC-programs is available, as well as the process of various end-user CNC-Cycle.

A flexible CNC program language serves a more than over the top commanding coverage of the definition program language (DIN 66025), with elements and structures, as used by the programmed high level language. (IF-THEN-ELSE, GOTO, FOR-WHILE-DO, CASE.....). A full integrated online look-ahead function affects in collaboration with the direct linear drives actuation a jerk-free positioning, even by the catchiest contour elements.

未來展望

由於軟性刀模生產的各種需求持續上升，其中在軟性刀模上鑽孔的課題，可藉由加裝Micro-Perf Add-On在GVM機械上來實現。此功能是在完成軟性刀模雕刻後，一次性的完成鑽孔加工。這些孔無論是排成直線或圓形，只要在我們的CAD/CAM繪出相關位置，就可以輕易完成鑽孔加工，與一般的雕刻成型的製作並沒有差別。另一個課題是 增加自動化生產的程度，因此我們也開發了使用更多刀具的換刀系統，目前GVM可提升到管理600隻銑刀

Outlook

The requirements of the production of flexible dies constantly rise.One topic is the processing of perforations. By using the Micro-Perf Add-On on your GVM engraving machine, you'll get the advantage to produce perforations in one step after the engraving job. It makes no difference, if this job needs to be done on straight lines or cycles — the Micro-Perf Advanced Add-On will follow the contour as programmed with our CAD/CAM system.

Another topic is to increase the degree of process automation, therefore we developed a special kind of a Multi Tool Change System, hereby the GVM engraving machine manages up to 600 milling tools. This option makes it unnecessary to update the standard tool magazine for each production job.

標籤機系統發展概況

Overview of Labeling machine system

魏趨吉 George Wei From AIC

前言

在系統櫥櫃生產過程中，每塊板件將會被貼上標籤，便於後續的封邊、組裝或做為其它特定的用途。2009年恩德公司為因應澳洲市場需求，在原有的SELEXX機器和上下料機構上，發展標籤機系統，以節省人力並避免人工可能造成的失誤。2009年恩德在自行研發的CAMpro軟體加入快速排版(Fast Nesting With List)功能。使用者只要將板件資料庫載入CAMpro，設定完相關加工參數，即能輸出加工所需的標籤檔案和NC程式。

加工流程

1. 透過CAMpro快速排版功能，將板件資料庫轉換成標籤檔案和NC程式。
2. 在機台上的DNC軟體設定加工排程。
3. 自動化加工依序為貼標籤、進料、切削、退料。

CAM pro 快速排版功能

板件資料庫：包含板件名稱、材質、顏色、尺寸、封邊、銑溝距離等資訊(如圖1)。

Introduction

During the production of system cabinets, each board piece will be labeled to facilitate subsequent edge bonding, assembly or for any other special purposes.

In 2009, to meet the market demand in Australia, Anderson developed the labeling machine system based on the existing SELEXX and feed-in/feed-out mechanism to save manpower and avoid possible human errors.In 2009, the CAMpro software solely developed by Anderson was added with the Fast Nesting with List function. Users only have to upload board database to CAMpro and set related processing parameters, the label files and NC programs required for the process then will be created.

Processing Flow

1.Board database is converted into label files and NC programs through the CAMpro Fast Nesting with List function(Figure 1).

2.The processing sequence is set through the DNC software on the machine(Figure 2).

3.The automatic processing sequence is labeling, feed-in, cutting, and feed-out.

圖 1 Figure 1

參數設定：以本文為例，資料庫材質有18mmE1板美白和6mm密底板美白，每種材質又包含切斷和銑溝二種切削方式，所以在載入資料庫後軟體自動拆成四個layer，每個layer必須設定對應的切削參數(style) 。

輸出標籤檔案和NC程式：在產生排版畫面的同時，軟體已輸出標籤檔案和NC程式。下圖顯示其中一塊板材，可以看到板件的排列方式，每塊板件中間藍框和紅色短線是貼標籤的座標和方向。

DNC排程設定：下圖即為DNC軟體介面，本例將由item1至item7順序加工七塊板材。所需設定的檔案除了板件資料庫以外，還包括七份標籤檔案和七份NC程式。

標籤檔案：標籤檔案包含標籤座標、方向及標籤內容，其中標籤內容是使用ZPL II標籤專用語言，傳送給印表機列印。下圖為實際標籤畫面，透過文字、圖形和條碼來顯示各種資訊，標籤右下角的P和A分別代表不同的封邊材質。

自動化加工

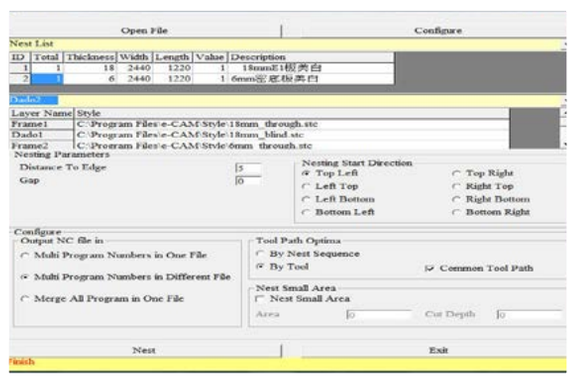
設定完DNC排程，按下機器上CYCLE START，整線系統將進行自動化加工：

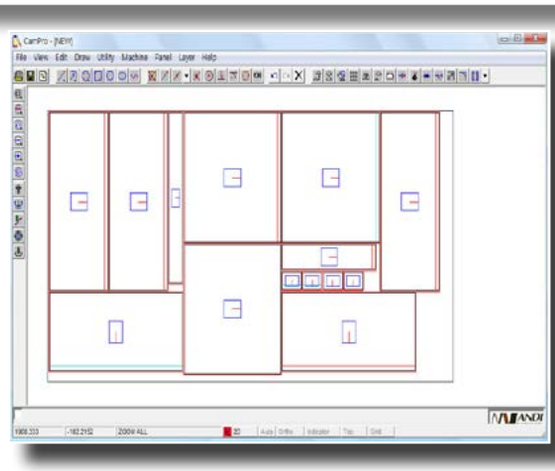
1. 貼標籤：底下照片為第一代的標籤機系統。印表機固定於XY軸伺服機構，到達指定的座標時，印出一張標籤，吸附裝置隨即將標籤貼附於板材上。
2. 進料：第一塊板材貼標完成後，標籤機系統和SELEXX的吸盤組，將板材送到SELEXX檯面上，此時油壓平台上升，第二塊板材將停到與第一塊板材相同的高度。
3. 切削： 第一塊板材切削的同時，標籤機系統進行第二塊板材的標籤貼附。
4. 退料 ：第一塊板材切削完成後，推料機構會將完成品推到輸送帶上，同時間吸盤組也把第二塊板材送到SELEXX檯面上。
5. 重覆上述步驟，直到完成所有的排程加工。

CAM prop Fast Nesting with List

●Board Database: Including information such as the name, material, color, dimension, edge bonding, and slotting distance of the board, etc.

●Parameter Setting: In the case of this article, there are the 18mmE1 white board and 6mm MDF board as materials in the database and each type of material encompasses two kinds of cutting methods, breaking and slotting. Therefore, after the database is downloaded, the software will automatically break them into four layers. For each layer, the corresponding cutting parameters (style) must be set.

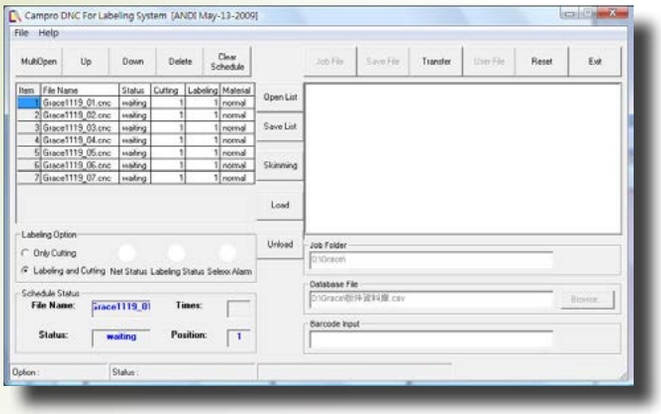


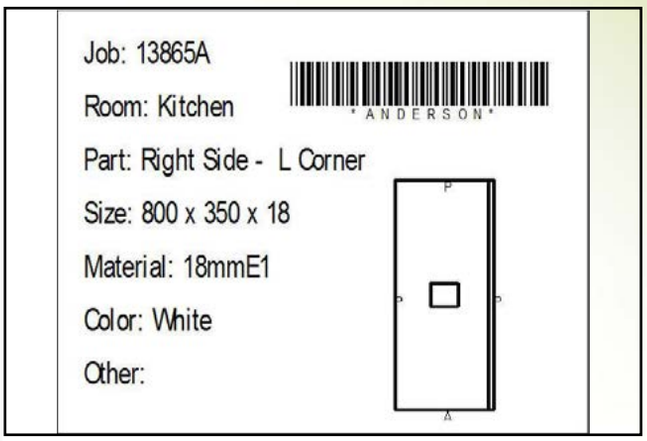


●Export the Label Files and NC Programs: While nesting is being processed, the software has already exported label files and the NC programs. The following figure shows one of the boards. We can see the array of the board pieces. The blue frames and short red lines in the center of each board piece indicate the coordinates and directions of how the labels should be applied.

●DNC Sequence Setting: The following figure shows the DNC software interface. In this case, seven boards will be processed sequentially from Item 1 to Item 7. Files that need to be set include not only the board database but also the seven label files and seven NC programs.

●Label Files: Label files containing information including coordinates, orientation and content of labels. Among them, the content of each label is sent to the printer and printed out with ZPL II label exclusive format. The following figure shows the actual label screen. All kinds of information are displayed through words, graphics, and barcodes. The P and A at the bottom of the right corner of the label indicate different edge bonding materials.





Automatic Processing

After the DNC sequence is set, press CYCLE START on the machine and the whole system will begin automatic processing.

1.Labeling: The photo below shows the first generation labeling machine system. The printer is fixed to the XY servo mechanism. When the assigned coordinates are achieved, a label is printed out and the attaching device will immediately apply the label onto the board.

2.Feed-In: Once the labeling of the first board is completed, the labeling machine system and the suction cup assembly of SELEXX will send the board to the SELEXX table. At this time, the hydraulic platform elevates and the second board will park at the same height as the first board.

3.Cutting: While the first board is being cut, the labeling machine system processes and apply the labels to the second board.

4.Feed-Out: Once the cutting of the first board is completed, the feeder mechanism will push the finished product to the conveyor. Meanwhile, the suction cup assembly will send the second board to the SELEX5.The aforementioned steps are repeated until all processing in the sequences completed.

5.The aforementioned steps are repeated until all processing in the sequences are completed.

壹、2010年恩德展示會 Exhibitions 2010

2010 CNC 精密機械展示會 CNC Exhibition

楊惟仁 Wei-Jen Yang
from AIC

3/4 ~ 3/8 印度展示會 (IndiaWood 2010) Indian Exhibition (IndiaWood 2010)

我們在印度有一代理公司為SANDEEP，將參加Bangalore展示會， 展示兩台機械SELEXX/MATE與OWEN S510。

We have one dealer SANDEEP in India that had be attended the Bangalore exhibition in where the two machines SELEXX/MATE and OWEN S510 was at display.

3/10 ~ 3/13 北京展示會 (WMF 2010) Beijing Exhibition (WMF 2010)

將由我們公司北京辦事處代表參加。

Our office in Beijing had attended the exhibition as representative.

5/4 ~ 5/8 義大利米蘭展示會 (Xylexpo 2010)

我們將與我們的新合作夥伴義大利 GIBEN，共同參與盛會，我們將展示三台機械。PTP-3010、SELEXX/BDT、SELEX/CHIEF；其中 SELEXX/CHIEF，將展示整線之加工方式，由貼標籤、上料、切削、到下料。

Exhibition in Milan, Italy (Xylexpo 2010): We will participate in the event with our new partner in Italy GIBEN and three machines: PTP-3010, SELEXX/BDT, and SELEX/CHIEF will be at display. For SELEXX/CHIEF, the complete processing method, from labeling, feed-in, cutting, to feed-out, will be demonstrated.

7/27 ~ 7/30 巴西聖保羅展示會 Exhibition in St. Paul, Brazil (FORMOBILE 2010)

我們將與我們的新合作夥伴，義大利 GIBEN 的南美分公司，共同參與盛會。

Exhibition in St. Paul, Brazil (FORMOBILE 2010): We will participate in the event with the branch office of our new Italian partner GIBEN in South America.

8/25 ~ 8/28 美國亞特蘭大展示會 Exhibition in Atlanta, U.S.A (IWF2010)

這是自恩德美國分公司與 OSI 公司合併後的第一個國際大展，雖然於 2009 年，世界景氣大衰退下，很多我們的主要競爭對手，不是縮編、就是宣佈倒閉；同時，很多世界級的大公司，亦紛紛宣佈退出展示。但是，我們公司反而是逆向操作，我們要讓客戶知道恩德是關心客戶，而擴大營運。

Exhibition in Atlanta, U.S.A (IWF2010): This is the first large-scale international exhibitions since consolidation of Anderson U.S.A with OSI. Despite the great depression throughout the world in 2009, when many of our competitors either restructured or declared bankruptcy, and numerous world-class giants announced that they would not attend the exhibition at the same time. However, our company does the opposite because we want our customers to know that Anderson cares about its customers and hence will expand its operations

9/7 ~ 9/10 上海展示會（Furniture Manufacturing & Supply 2010)

將由恩德大陸子公司上海辦事處代表參加。
Shanghai Exhibition (Furniture Manufacturing & Supply 2010): The Shanghai office of the subsidiary of Anderson will attend the exhibition as representative.

9/27 ~ 10/1 蘇聯莫斯科展示會 (LESDREVMASH 2010)

我們將與我們蘇聯代理 We.R.SUPPLY一起參與。
Exhibition in Moscow, Russia (LESDREVMASH 2010): We will participate in the event with our Russian dealer WE.R.SUPPLY.

10/3 ~ 10/6 英國伯明罕展示會 (W10 2010)

我們將與我們英國代理RW一起參與。
Exhibition in Birmingham, U.K (W10 2010): We will participate in the event with our British dealer RW.

10/16 ~ 10/20 土耳其伊斯坦堡展示會
Exhibition in Istanbul, Turkey (WOOD PROCESSING MACHINERY 2010)

2010 PCB 電子機械展示會 2010 PCB EXHIBITION

3/16 - 3/18 CPCA SHOW(上海電路板展覽會)

4/27 - 4/29 KPCA SHOW（韓國電路板展覽會）

5/12 - 5/14 蘇州電路板展覽會

10/20 - 10/22 TPCA SHOW （台灣電路板展覽會）

4/16 ~ 4/17 恩德公司與OSI公司於

2010年1月1日正式合併，稱為ANDERSON GROUP AMERICA，任 命前恩德美國分公司之總經理，Mr. Raymond Ward，擔任此一合併後之CEO。公司也已租一辦公廠房，約38,000平方呎，將於4月16日正式對外宣佈，恩德集團之一新紀元。

在這一片不景氣的環境下，恩德公司反而是逆向操作，擴大營運，如此，傳遞一重要訊息給美國廣大的客戶〝恩德公司將更積極地服務您們，絕不退縮〞

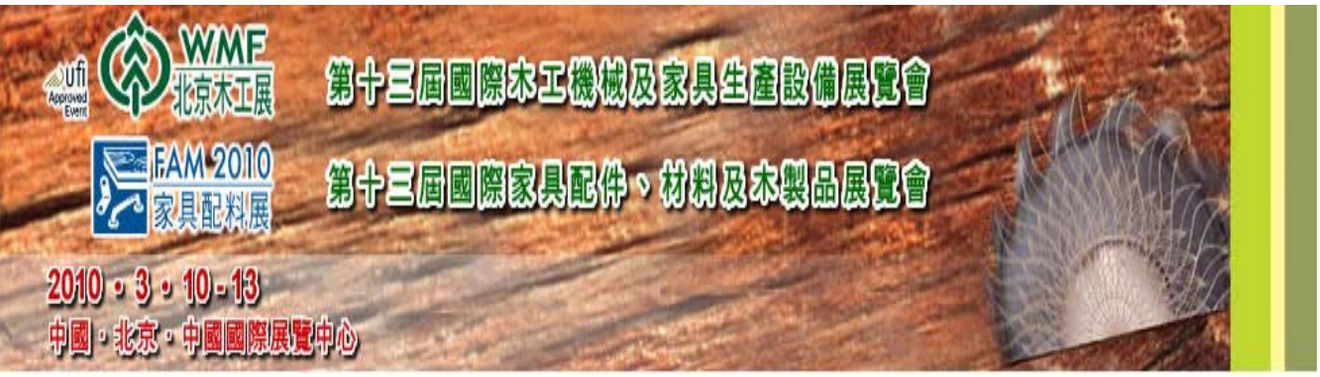
與義大利木工機械製造廠(GIBEN International)合作聯盟

在 2009 年，不只恩德公司，全世界在不同行業別之每一公司，都遭遇到了歷史以來之經濟大衰退。每一公司都在尋求出路，因此，GIBEN 的老闆便提出與恩德策略聯盟的構想。於 2009 年 7 月，他親自來台拜訪謝董，表達合作的意願，在謝董擔任導遊，帶領 Mr. Benuzzi (GIBEN 的老闆) 參觀恩德每一個製造廠與研發部門，讓他驚豔不已，加深他要與恩德策略聯盟的信念。謝董也特地於 2009 年 10 月，飛到 GIBEN 之總公司，義大利的 Bologna 做禮貌性的拜訪。2009 年 11 月底，開始著手進行合約的編輯，於 2010 年 2 月 9 日正式簽署，並交換合作合約，預計於 3 月底左右，謝董將與 GIBEN 之老闆正式舉行記者會，一同宣佈兩家公司之策略聯盟計劃。兩家公司的策略聯盟，彼此可以得到互補、互惠、互利。

Anderson had been merged with OSI on January 1, 2010 into ANDERSON GROUP AMERICA. The general manager of the former Anderson branch office in the U.S.A, Mr. Raymond Ward, continued to serve as the CEO of the company after the merger. The company has also rented an office and factory complex with an area of around 38,000 square feet. The news will be announced officially on April 16. It features a new era for the Anderson Group. Despite the common unfavorable environment, Anderson does the opposite and continues to expand its operations. By doing this, we are sending a message to the vast clientele in the U.S.A: "Anderson will work more proactively to serve you without any hesitati

Partnership with ItalianGIBEN International

In 2009, not only Anderson but also other companies in all walks of life around the world suffered from the historical economic turmoil. Every company was finding a way to survive. Therefore, the owner of GIBEN, Mr. Benuzzi, initiated the idea to form a strategic alliance with Anderson. In July 2009, he visited President Hsieh personally in Taiwan to express his intention to establish partnership with Anderson and visited each of Anderson's manufacturing plants and the R&D department with President Hsieh as the tour guide. Mr. Benuzzi was impressed with Anderson and this visit consolidated his determination to become a strategic partner of Anderson's. President Hsieh also flew to the headquarters of GIBEN in Bologna in October 2009 for a courteous visit. In November 2009, the drafting of the contract started and the contract was signed officially on February 9, 2010 and exchanged. It is expected that around the end of March, President Hsieh and Mr. Benuzzi will hold an official press conference to jointly announce the strategic partnership between the two companies. The strategic alliance is complementary, reciprocal, and advantageous to each other.



北 京 木 工 展 會 概 況

The International Exhibition of Woodworking Machinery and Furniture Manufacturing Equipment (WMF)

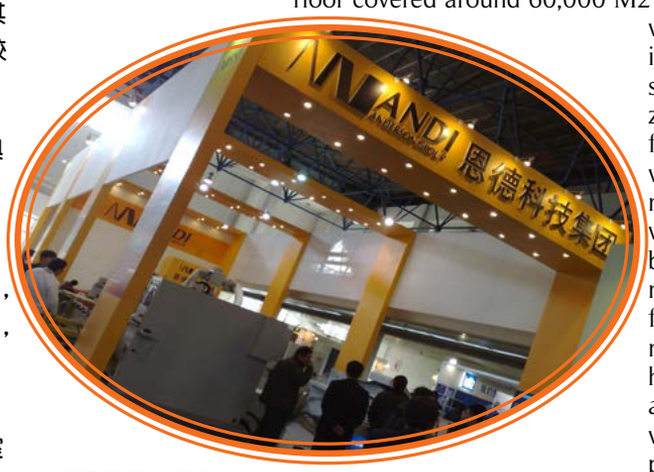
魏麗霞 Shirley Wei from AIC

北京木工展」是每兩年舉辦一次，自 1986 年起至今。而今年的「北京木工展 2010」及「家具配料展 2010」是第十三屆，在北京的中國國際展覽中心展出，日期自 2010.03.10~2010.03.13 為期四天。主辦單位稱說此展媲美於德國的漢諾威 (Ligna) 及義大利米蘭展 (Xylexpo)；展會面積約 60,000 M2(平方米)，分四大專區，包括木工機械專區、人造板機械專區、家具材料 / 五金配件 / 木製品專區及木工機械配件專區等，共九個展覽館。約有 600 家廠商參展，來自德、義、法、荷、西班牙、馬來西亞、俄羅斯、新加波、台灣及中國等十多個國家。其中以德國，義大利及台灣展團較大較多。

恩德此次攤位座落在二號館，與德國展團及台灣展團同一館。展出噴墨機 (Cojet 2612)、NC-2525TC2、Selexx ECO、OWEN S48 及 PTP-3013 共五台機械設備，由胡增榮經理領軍，兩位業務，四位服務人員及一位助理，駐守在恩德 2E01 的攤位。

三月十號 (周三) 開展第一天，室外雖陽光普照，但溫度卻僅在攝氏 0 ~ 1 度間滑行，沒下雪但也冷得讓人不禁直打哆嗦。十點整，一串震耳欲聾的鞭炮聲，揭開此北京展的序幕。透過喧嚷吵雜的廣播聲中，好似聽到某某市長，某某局長，及幾位大人物的蒞臨致詞，而此時參觀者也開始陸續魚貫進場。

The International Exhibition of Woodworking Machinery and Furniture Manufacturing Equipment (WMF) has been held once every two years since 1986. This year, WMF 2010 and FAM 2010 at its 13th session were held at the China International Exhibition Center in Beijing from March 20th, 2010 to March 13th, 2010 for four days. The organizer indicated that this exhibition was compatible to Ligna in Hannover, Germany and Xylexpo in Milan, Italy. The exhibition floor covered around 60,000 M2 in area and was divided into four specialized zones, featuring woodworking machinery, wood-based panel machinery, furniture materials/ hardware accessories/ wooden products, and woodworking machine accessories. There were nine exhibition halls in total. Around 600 manufacturers from more than ten countries, i.e. Germany, Italy, France, Holland, Spain, Malaysia, Russia, Singapore, Taiwan, and China participated in the event. Most of the manufacturers were from Germany, Italy



恩德攤位左前方是日本平安 (Heian)，展示一台 2513 及門板的樣品。右側是如隆 展示一台 PTP; 中工展出五軸及雙台面兩款機台。再右側則為台灣其他展團如環虹、勝源、振蕭…等。正對面及右前方則為德國展團如 AKE、LEITZ、SIKO…等。

遊走穿梭九個展館，外資館中不見熟悉的木工產業設備界的大哥大－德商 Homag（豪邁，金田），也不見義大利的 Biesee；傳言說他們不參與此次展會，是在抵制會場驚人的高額收費。但也有人說 2009 年的金融海嘯確實讓此大型公司元氣大傷。然而蓬勃發展的中國國產木工機械業卻也讓歐洲及台灣的零件設備供應商趨之若鶩，各展身手想盡策略，搶食這塊鑲了金，閃爍奪目的中國大餅。

在近 200 家中國國產木工機及雕刻機設備廠中，可很輕易的發現台灣 SYNTEC 控制器，義大利 HSD 主軸、頭組；德產及台灣製的線軌齒排等零組件都已大量應用在中國境內本土機械製造商的產品上。各家大同小異的外型設計，採購自德、義及台灣的組件，真好似複製品般陳列在不同的展館，在行家中比的是結構剛性，切削穩定性，售價與售後的服務。而這些中國國內的本土製造商如工友（威海）與國家研究單位技術合作，據說擁有國家政府的支援，從最簡易的 NC 兩款機械著手，在短短五年內就在新加坡及德國掛牌上市。另外來自山東濟南及萊州的幾家廠商，其規模雖沒恩德的大與完整，但這兩年他們在結構上的改善及採用來自德國的線軌、義大利的主軸及台灣的控製器…等，及他們自己開發的應用軟體等等，都可嗅出這些本土廠商企圖扭轉市場對中國大陸產品劣質、價位低廉的刻板印象。其成長的速度好似幾何級數的向上攀升，可看出他們在市場佔有率及行銷國際化的野心與企圖，真的不容輕忽，等閒視之。

為期四天的展會中，人潮不如預期的多，但相較於上一屆 (2008) 三萬到訪人次確實較少。在來訪流動的人潮中大都會被恩德的噴墨機給吸引。因此機種在

and Taiwan.

Anderson's booth was located in Exhibition Hall 2, the same as the German exhibitors and Taiwanese exhibitors. The inkjet (Cojet 2612), NC-2525TC2, Selexx ECO, OWEN S48 and PTP-3013, five machinery equipment in total, were at display. Led by Manager Zeng-Rong Hu, two sales representatives, four customer service representatives, and one assistant were representatives at the Anderson Booth 2E01.

On the first day of the exhibition, March 10th (Wednesday), the sun shined outside but the temperature was fluctuating between 0 ℃ and 1 ℃ . It did not show but was freezing to death. At 10:00 sharp, this exhibition in Beijing opened in the midst of a series of noisy firecrackers. Among the noisy broadcasts, one could barely hear the speeches from some mayor, some director-general, and several other important speakers. At the same time, visitors started to follow one another and entered the exhibition hall.

In the front left of the Anderson booth was Japan Heian, exhibiting 2513 and samples of door panels. On the right side were Rulong, exhibiting a PTP; and BES, exhibiting two machines in models of five-axis and twin-table. On the further right were other exhibitors from Taiwan, such as Huang Hong, Leadermac, Jun Shiau, etc. In the front and front right were exhibitors from Germany, such as AKE, LEITZ, SIKO…

Throughout the nine exhibition halls, the leaders in the woodworking equipment industry, Germany Homag and the Italy Biesee, were no where to be found in the Foreign Capital Hall. It was said that they did not participate in this event to show their protest to the unreasonably high fee for the booth. However, some said that it was the 2009 financial tsunami that deeply hurt large companies like them. However, the flourishing woodworking machinery industry in China also attracted parts and equipment suppliers from Europe and Taiwan. Each of them goes all out and thinks of any strategy that is available in order to gain a share in this golden and promising Chinese pie.

Among nearly 200 Chinese domestic woodworking machines and engraving machines manufacturers, one could easily spot the Taiwanese SYNTEC control, Italian HSD spindle and head sets, and Linear guide rails, and rack and pinions, among other parts and accessories made in Germany and Taiwan have been largely applied in the products of Chinese local machine manufacturers. The highly identical external designs with slight difference where accessories from Germany, Italy, and Taiwan are used to look like duplicates displayed in different exhibition halls. Experts would compare their structural rigidity, shearing stability, selling prices, and after-sales services. In addition, these Chinese local manufacturers, such as Gong Yo (Wei Hai), worked with the government research institutes. It was said that with support from the government, they could start with two models of the easiest NC machines and have their initial public offering in Singapore and Germany within merely five years. In addition, from other manufacturers from Jinan and Laizhou of the Sandong Province whose scale is not as large and complete as that of Anderson, but their improvement in structure, the application of the linear way from Germany, spindles from Italy, and controller from Taiwan, etc., and the application of their self-developed software, that it was not difficult to feel that these local manufacturers were trying to shift the market's stereotype toward Chinese

市場上尚未普及。因此訪客對此機非常好奇，並駐足圍觀在 Cojet 旁，問應用、噴印速度、墨水來源及設備售價等。其中又以來自俄羅斯的客戶，問題詢問的多且較深入，表現高度的採買意願。針對會場中陳列著木板、磁磚、玻璃、壓克力…等不同材質的樣品，與 show time 展示木質花紋的圓桌面噴繪 現場參訪者無不張目結舌嘖嘖稱奇。有一潛在客戶，在來訪隔天就將拿其工廠內貼好皮、封好邊的成品要我們現場噴繪試探效果。而斯文的表現也讓此客戶很滿意，後續就由北京業務與客戶聯繫追縱了。

中國國內的參訪者有許多是恩德現有的客戶使用者，大都從事木工加工業，當然也有第一次聽到恩德的，這些國內的客戶除了來自北京外，也有不少來自其他省市。而外來的參訪者有來自俄羅斯、美國、波蘭、以色列、希臘、沙烏地阿拉伯、印度、依朗、土耳其、日本、越南…等。但大部份是來尋求代理合作意願。

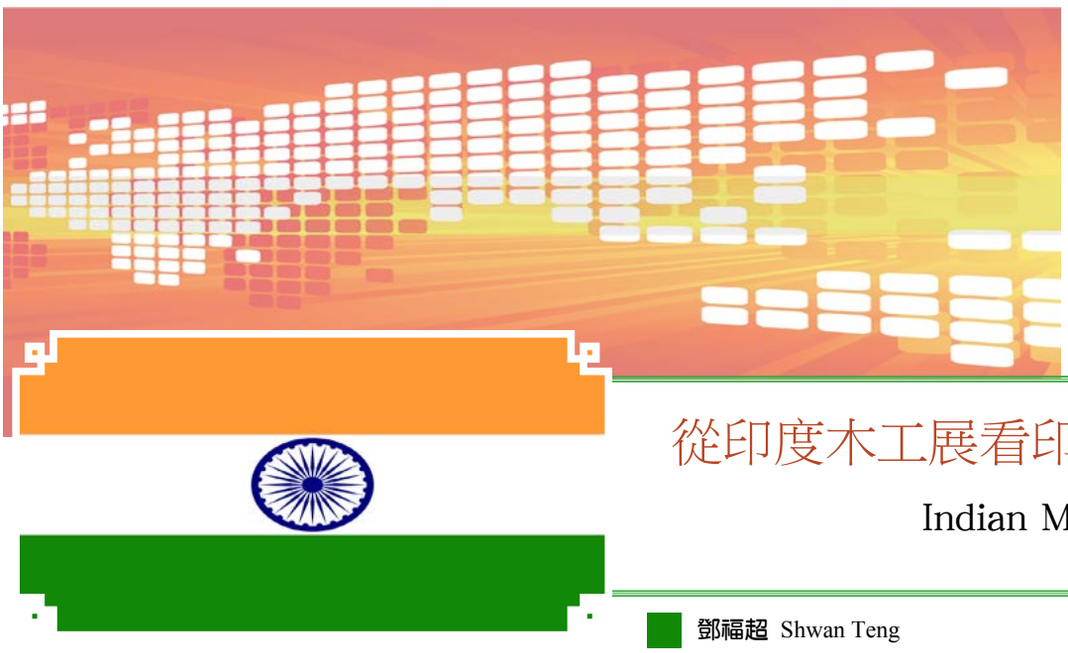
中國藉由 2008 奧運成功的向國際推銷，及今年 2010 的世博會將市場需求炒得熱鬧滾滾，無論內需或外銷，如同超級大磁鐵吸引著全球商機。在會場中，只見吳總手機不停的響，不停的與上海松江廠及業務單位協調機台訂單及交期。以恩德目前的集團規模，產品的種類，可因應中國廣大的內需市場，若能加速廣設辦事處，或相關二線大城市增加新的銷售據點，恩德營業額在中國這塊土地上，將有更多的成長空間，恩德 2012 年總營業額要達新台幣 100 億的夢想將是指日可待 !!

products of having bad quality and cheap in price. Their growth pace is swirling upward exponentially, which showed their ambition and intention to the market share and global marketing are unable to ignore and cannot be underestimated.

During the four-day exhibition, the visitors were not as many as expected. However, compared to the previous session (2008), despite the little less headcount of thirty thousand people, the difference was not drastic. Most of visitors were attracted by the inkjet printer of Anderson because this type of machine has not been popular on the market yet, so the visitors were very curious about the machine and stopped to observe Cojet. They asked about its application, jet printing speed, source of ink, and selling price of the equipment. Among the inquirers, most were visitors from Russia. They asked the most questions in the most depth, who demonstrated high willingness in making purchase. Since there were wooden plates, ceramic tiles, glass, acrylic, and other samples of different materials, during the show time on site, printing on the round table with wooden textures was demonstrated, too, and visitors also shown their astonishment. One prospective customer informed us that they would bring their finished products with attached leather and well-bonded edge the next day to site and let us print on them to test the effect. The smooth expression had satisfied the customer, and the following manners are handed to our sales representatives in Beijing for contact and tracking of the customer.

Many of the Chinese visitors are existing users and customers of Anderson's, and most of them are in the woodworking industry. Of course, there were also visitors who heard of Anderson for the first time. There were also quite a few visitors from other provinces who are not local Beijing people. International visitors included those from Russia, America, Poland, Israel, Greece, Saudi Arabia, India, Iran, Turkey, Japan, Vietnam, etc. and most of them were exploring dealership and collaboration opportunities.

China successfully marketed itself to the international society through the 2008 Olympic Games, and the Expo 2010 will further heat up market demand. Both domestic demand and exports are like two super magnets attracting business opportunities from all over the world. On the floor of the exhibition, one could see that General Manager Wu's cell phone never stopped ringing, and he was busy coordinating machine orders and delivery dates between the Songjiang Plant in Shanghai and the sales unit. The current scale of the Anderson Group and its diversified product lines are sufficient to meet the vast domestic demand in China. If more offices can be established quickly, or new sales locations are added in the second-line major cities, the growth in Anderson's revenue in China will be even greater. It will not be long for the Anderson's total revenue to reach NT$10 billion in 2012.



從印度木工展看印度 CNC 市場

Indian Market Information

鄧福超 Shwan Teng
from AIC

地點：Bangalore, India（班加羅爾，印度）
日期：4th~8th of Mar. 2010
任務：India Wood（木工展示會）
前提：
人口數： 十一億（世界第二）。
面積： 約三百萬平方公里，居世界第七位。
首都： 新德里（New Delhi），位處北印度。
最大都市： 孟買（M umbai）世界第六大都會區，人口約兩千五百萬。
語言： 印地話（官方語言），其它有十四種半官方語言，另外，尚有各地方言超過 1,600 種。普遍來說，英文是可以在印度這個國家溝通的，因為被英國統治過的原因，就連不同種族的印度人溝通幾乎都是用英文。

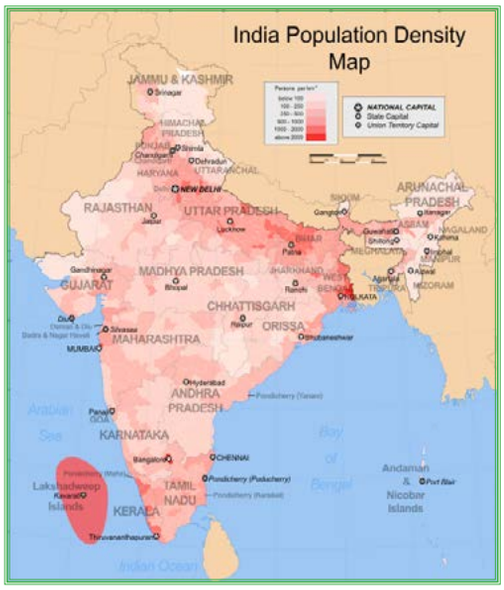
ILocation: Bangalore, India (Bangalore, India)
Date: 4th ~ 8th of Mar. 2010
Tasks: India Wood (Woodworking Fair
Premise:

Population: 1.1 billion (the second most of the world)
Area: Approximately 3 million square kilometers, ranking the seventh in the world.
Capital: New Delhi (New Delhi), located in North India.
The Largest City: Bombay (Mumbai) the sixth largest metro area of the world, with a population of about 25 million.
Language: Hindi words (official language) and other 14 kinds of semi-official languages. In addition, there are over 1,600 kinds of various regional dialects. Generally speaking, English can be used to communicate in this country, because it was ruled by the British. Even the communication between different ethnic Indians are almost all by English.

印度市場，一向被外界人士視為極有潛力的地方，也是各界搶食的大餅，人潮就是錢潮，這邊的人的確很多，國家也十分需要建設，對於這樣子的市場，我們設備商是非常有機會在這個新興市場創造商機的。

但是與中國相較之下，這個市場缺乏了一項優勢，就是集權有資金的政府，印度貧富差距非常懸殊，GDP 約為 USD978.-，為資本主義以及共和憲法的國家，正因為如此，使得國家要推動發展的速度會比較緩慢，加上 39% 的人民是沒有識字能力的，另外的 61% 也有大部分的教育水平較為低落，因此，要走向康莊大道，印度還需要一些時間以及其他各國的投資以及援助。

此次展會中，就屬 HOMAG 集團的聲勢最為驚人，展場共有三館，其中一館幾乎就是被 HOMAG 所包辦了，就當地代理資訊，HOMAG 本身也是尋找當地人做為代理來開發市場（印度人一定要由印度人接洽，這就是民族性），不同的是，HOMAG 是把代理當作子公司一般的支援，展出最齊全的機種，



展會最大的攤位，擺放最多的庫存，提供最短的交期，一切的外援都是由 HOMAG 包辦，而不是由代理本身支出。BIESSE 在 HOMAG 旁邊就相形遜色了些。

在二館中，有印度三大木工機械代理，（全印度約只有十家木工機械代理商）JAI 與 SCM 合作，HRB 與 HOLZHER 及 IMA 合作，WOODTECH 目前與 MASTERWOOD 合作（將來透過 GIBEN 的關係將與 ANDERSON 合作），而恩德目前與 SANDEEP 合作，雖說 SANDEEP 不算是大的代理商，但卻是很有誠意的代理商，也十分願意與恩德合作。因為 CNC 木工機械在印度的市場來說算是高科技，最被印度市場需要的木工加工機，若在展會沒有展出 CNC 機台，那麼絕對吸引不到人潮，現在最值得投資在印度的木工產業中就屬 CNC 加工中心了，其它的小型加工機，可以買中國便宜的機種，或是使用現有的舊機械加工，但是 CNC 加工中心目前對印度市場來說尚未有取代品，因此值得當地工廠投資。

印度市場目前的銷售一直無法有很好的成績出現，主要原因為價格，印度普遍來說所得不高，要一次投入龐大資本於一項新興的技術 CNC 是需要深思熟慮的，目前中國的機種雖然便宜，但是還不穩定，因此，買主還是會考慮較高價位的製造商，但是既然要投入資金於較高門檻的製造商，品牌優勢也變得相當重要，印度人民有相當程度的崇洋氣息，因此歐洲或是美洲的製造商變的比較有機會，而恩德的優勢在於機台穩定性高，較為耐用，價位也還不到歐美製造商的門檻，因此還是有一席之地。若是要打開印度這個市場，前期的投資是不能少的，宣傳打知名度是必要的，降低機械的成本與售價是必要的也是製造商的宿命，穩定度高且重切削的主軸是必備的，目前接觸到印度的客戶加工材料都普遍是較硬的材質，較耐用，壽命也較長，如：high density laminated wood boards , composite materials like epoxy fiberglass , paper based phenolic laminates , transformer boards, precompress pressboards，這跟印度人民的建築習慣也有關係，MDF 等材質在印度是較不受用的，一般看來，建造的民房都是水泥房，木造房屋幾乎沒有，室內裝潢大多為堅硬木材，系統家具在印度較少看到，不過廚房廚櫃的輕薄建材蠻多的。門板的話實木材質稀少，都是輕巧的材質居多。其它傢俱就以金屬或是玻璃居多。三館的話，就以建材為主，多數為歐美展商。

假以時日，中國的製造商技術成熟，產品穩定，將會是非常難纏的對手，因為價格實在無法抗衡。此時將品牌形象建立穩固，會是一個不錯的時機，也會是市場細水長流的基礎。

Contents:

The Indian market has always been regarded as a potential area by outsiders, also a battlefield for people from all walks of life. The crowd is the money. Indeed, the population of India is huge, and the country also requires constructions very much. The whole India is an emerging market where the equipment manufacturers have much more chances to develop business opportunities.

However, compared with China, India market lacks of a prepotency – that's a centralized government with funds. India has a huge gap between the rich and the poor, and the GDP is around USD$978. It is a country with Capitalism and Republican Constitution. Those are the reasons why the country has a slower speed in promoting development. Moreover, there are 39% of the people are illiterates, while the other 61% are mostly with lower educational levels. Therefore, to reach easier condition, India still needs some time, and investment and assistance from other countries.

In this fair, HOMAG Group was the most massive one. In the exhibition, there were three halls, and one of them was almost occupied by HOMAG. According to the information provided by local agents, HOMAG Group also develops the market through local agents (the Indians must be approached by the Indians, it's the nationalism). The difference is that HOMAG provided the agents with supports which were the same as the ones they provided for their affiliates. The most complete models to show, the largest exhibition booth, the largest inventory and the shortest delivery period were all supported by HOMAG, but not by the agents. Compared with HOMAG, BIESSE seemed a little inferior aside.

In Hall II, there were three major woodworking machinery agents which were the largest three in India

(There are only about 10 woodworking machinery agents in India). JAI cooperates with SCM, HRB cooperates with HOLZHER and IMA, and WOODTECH are currently working with MASTERWOOD (in the future, it will cooperate with the ANDERSON through the relation with GIBEN). And Anderson is currently working with SANDEEP. Although SANDEEP is not a big agent, it is a very sincere one who is also very willing to cooperate with Anderson. Because the CNC woodworking processing machines are considered as high-tech products in the Indian market, if they cannot be shown in the exhibition, the booth will not be able to attract the crowds due to the Indian market demands for CNC woodworking processing machines very much. The most worthwhile woodworking industry to invest in India is the CNC processing center. For other small-scale processing machines, it is possible to buy cheap Chinese models, or use the existing old machine to process. But for the CNC processing centers, there are no substitutions in the Indian market yet. Therefore, it is a worthy investment for local factories.

However, the current sales have been unable to have a good result there, and it is mainly due to the price issue. Generally speaking, the income in India is not high, that they need to think over carefully to make a huge investment in CNC which is still an emerging technology. Although the China models are cheap, they are still unstable. Therefore, the buyers will still consider of buying those with higher prices from other manufacturers. However, since it is necessary to invest the manufacturers with a higher price, brand becomes very important. Indian people have a considerable degree of xenophile, so the European or American manufacturers will have better opportunities. However, Anderson has the advantage of high stability and more durability with the price that's less than the European and American manufacturers, and therefore there is still a market for us. If we want to step into the Indian market, investment shall not be skipped, which is necessary to promote the name recognition. To reduce the cost and price of machines is necessary, and it is inevitable for manufacturers. Spindles with high stability and heavy cutting are also essential. The Indian customers that we have contacted recently usually use hard materials for processing, because it is more durable and has longer lifetime. For example, they used high density laminated wood boards, composite materials like epoxy fiberglass, paper based phenolic laminates, transformer boards, and precompress pressboards, etc. These are also related to the construction habits of the Indian. MDF and materials are not very acceptable in India. In general, the constructions of the houses are all made of concrete, and there are almost no wood made houses. The interior decorations are mostly made of hard woods. System Furniture is rarely seen in India, but the light materials are frequently used in the kitchen cabinets. As for doors, solid wood materials are rare, while the majorities are made of light materials. For other furniture, metal and glass are the majority. In Hall III, there were mostly building materials, and most of them are European and American exhibitors.

After some time, when Chinese manufacturers have mature technology to make their products stable, it will be a very strong opponent because the price is unbeatable. At this point, it would be a good time to build a solid brand image, which will be a steady way for the company to go on.

秋收「東」藏 、「吳」遠弗屆

Harvest in Soochow and Benefit Forever

侯建富 Jeffrey Hou -
from ANDERSON GROUP

有幸於去年下半年度拾起當學生的心情，成了董事長的學生。短短一學期的時間，每次足足三個小時的課程，重新瞭解企業創辦人的心路歷程，管理哲學。 這絕對不是上班族能夠得到的機會及收獲，半年來彷彿讓人脫胎換骨。

拜賜恩德自辦季刊誕生，容許將這半年來的增益精華與集團內的同仁分享。課程為「企業經營管理實務」。由時事主題『金融海嘯是誰惹的禍』出發，帶領我們深入企業內部分析經營管理。期中更穿插企業國際化，最後以 5M 為主的營運計劃結束課程。事實上步調是相當緊鑼密鼓 生動有趣。

課程當中老師個人對時事及企業經營管理上的獨到剖析，常常讓課堂上同學瞠目結舌。除了符合目前企業界經營特性之外，比較五年前我在政大上的三門課程，差異相當大。最大的不同在於課堂上所學能實際利用於每天工作上，而政大的課程仍較著重於廣泛理論的探討，而鮮於專業實務上的發揮。

在短暫的五個月當中，老師在課堂中談到的經營”魔咒”。也是同學們之間津津樂道的。例如，談到人性貪婪。金融海嘯，更精僻列舉人性弱點“需要的不多、想要的太多”。又如在幾次授課中強調求知的方法，“吞下去、吐出來、嚼一嚼，再吞下去”才能成為自己所有。還有老師常提起的領導者的條件，要有”格局、智慧、風範、決策力”。等等許多的”經營魔咒”。再再將管理中精華傳授給學生。

進入課程的最後一階段是五組學員的期末報告。以 5M(Merchandise －產品、Money －財務、Man －人、Marketing －行銷、Management －管理）做為主軸架構。進行期末分組報告當中，各組表現可圈可點。其中有兩組的表現確實讓人印象深刻，老師利用此次營運計劃書的撰寫及討論 讓學員學習規劃產品 制定財務計劃。如何思索”選、訓、用、留”的人力策略，加上有效的利用行銷的力量達成營運總目標。當然一定要事先、後善用管理手段掌控運作。

秋收冬藏，無遠弗屆。第一次在東吳正是秋天的開始，也正因秋天的收穫，才能成為未來在職場上的存糧。更因有能量的累積，才能看的更高、走的更遠、做的更好。這半年來真的感謝老師在課堂中無私的傳道授業。雖然課程已經結束，更希望，未來能有機會在”恩德研究所”中讓更多的同仁，聆聽老師如沐春風的諄諄教誨。

I was fortunate to become a student of the president in the later half of last year. I took his class for a semester only. Each session lasted three hours. He gave me a new perspective of the experiences of a business founder, and shared his philosophy of management. The opportunity and the gains are not something available for an office worker. I feel that I am a different person after the six-month studies.

Thanks to the establishment of self-run Anderson Quarterly, I am able to share the best part of the past six months with colleagues in the Group. The course was titled "Practice of Business Administration and Management". It kicked off with the contemporary event-oriented topic "Who is to Blame for the Financial Tsunami?" and went deeper to analyze the administration and management within an enterprise. Throughout the course, we discussed internalization of businesses, and ended the course with the operation planning featuring 5Ms. The pace of the course was very quick and intense, as a matter of fact. Nevertheless, it was energizing and interesting, too.

In class, the teacher shared his exclusive analysis of contemporary events and business administration and management, which often astonished the listeners. In addition, the course possessed the management characteristics in the contemporary business community, it was quite different from the three courses I took at the National Chengchi University five years ago, with the biggest difference that I was able to apply whatever I learned in class to my everyday work this time. The courses offered at the National Chengchi University are still more focused on extensive theoretical discussions with little touch of the performance of professional practice.

During the short five months, the teacher talked about the management "spells", which is one of the topics that classmates took delight in discussion. For example, he mentioned the greedy nature of human beings that the financial tsunami unveiled. He listed weaknesses of human beings through penetrating viewpoint, that people "Do not need much, but want too much." He also emphasized the approach to knowledge several times in class. He said that you must "swallow it, spit it out, chew it, and swallow it again" to internalize the knowledge. In addition, the teacher often mentioned the requirements of a good leader. A good leader must have " style, wisdom, example-setting character, and decision-making power." All of these are "management spells." Like listed above, he had passed down the best part of management experience to his students.

At the last phase of the course, students in five groups had to submit final reports on the framework of 5Ms (merchandise, money, man, marketing, and management). During the final group presentation, each group had shown their best performance. Among them, two groups were especially impressive. Through composing and discussing of the operation plan, the teacher gave students the opportunity to learn how to plan products and establish financial plans, to think about how could they "select, train, use, and retain" the manpower, and to accomplish the final operation goal by using marketing power effectively. Of course, this requires good application of management tactics before and after the presentation.

Harvest in fall and store in winter, infinite and borderless. The first time I attended class in the Soochow University was the beginning of fall. It was exactly the harvest in fall that prepared me well for the future on the workplace. It is also because of the storage of energy that I am able to look higher, walk further, and do a greater job. I am truly thankful to our teacher for his unselfish teaching and passing down whatever he knows during these past six months. Although the course has ended, I hope that I will have the opportunity to pass down the lectures as fine as a breath of fresh air from the teacher to more colleagues in the future, in the "Anderson Institute".

推動主軸品質成長的動力-MES

The Motivation of Spindle Quality Development-MES

王元男 Jason Wang
from Anderson Group

1> 為何主軸生產需要架構 MES

一般製造業所謂的營運管制系統 (Manufacturing Execution System, MES)，是指生產現場電子化與製程之控管。概念上 MES 系統以即時的方式，收集生產製程中各種資訊，供生產與管理者等參考，同時經由即時的資料整理與分析，深化為生產線上品管的依據。生產完後的資料彙整與統計分析 協助管理者找到更好的管理與品質決策。由此可見，從生產開始到生產結束，MES 系統可說是管理者全方位的小幫手。除此之外，MES 講究製程資訊管控透明，管理者容易掌握生產流程的變異，能有效追蹤、管理、控制製造活動中的在製品，並提升生產效率，降低無效工時的產生。主軸的生產為何需要 MES 系統，其理由有三：

(1)主軸生產時，由於相關零件精度高，需要適合的零件相互匹配，所以需要即時的零件公差資訊，以供生產配對決策。
(2)主軸服務要求較高的追溯性，必需有更完整的製程資訊，來協助解決維修問題。
(3)製程精度與使用壽命息息相關，提升主軸品質需藉由製程資訊分析，找出最佳的精度參數。

以上這些主軸製程的需求，正好是 MES 概念的核心價值，也是我們導入 MES 系統的理由。

1> Why a Spindle Production needs to implement MES system

Generally speaking, the Manufacturing Execution System, MES in the production field is a manufacture control system by means of production data electronized and process monitoring. The system will collect all kind of information during production process in a real-time manner, and provide it to production and management supervisors for their reference.Meanwhile, the system, with real-time sorting and analyzing of the data, is able to be a reliable foundation for the quality control of production line.The production data after being sorted and analyzed by statistics, could assist the supervisors to find better policies to manage the quality.There, it is obvious to understand from the beginning to the end of production, MES is a helper for the supervisors in all aspects. Besides that, the concept of MES is focused on the clearness of the process data monitoring, it will be easier for the supervisor to follow up the deviations from the production flow, to effectively track down, manage and control the WIP during the production activities, for improving the production efficiency and reducing the occurrence of the ineffective working hour.

There are three reasons why the spindle production needs MES:

(1) During the production of the spindle, due to related parts required high precision, it will need to be assembled with proper parts. Therefore, the real-time data for tolerance of the parts is required.
(2) The service for a spindle requires a higher demand of traceability. A complete production data at the time of processing is needed for assistance to obtain a solution for maintenance.
(3) The precision is highly related with the life cycle. To raise the spindle quality, it will require a data analysis from the damaged spindle to find the best precision parameters for the spindle assembly.

The demands mentioned above required by the process of the spindle are exactly the core value of MES, and they are also the reasons for us to implement the MES concept.

2> 主軸生產的MES概念

主軸的生產主要涵蓋備料、組立、與測試等三個主要階段，其中組立與測試依不同主軸的組立特性，又可向下分出幾十道次階段，其中包括零件驗證、拉力系統組立、軸心動平衡、前軸承座組立、後軸承座組立、全轉速動平衡、電流測試、溫升測試、靜態偏擺、動態偏擺、靜態剛性、拉吐刀測試等。這些製程前後息息相關，需要即時資訊提供給下一站的生產者，讓生產者能即時的修正與改善，或找出較適合的匹配型式，避免到製程終點才發現品質不良，又要拆除重新組裝，既浪費時間，同時有可能拆除時又造成零件損害，為解決這些問題與發揮製程的管控功效，我們規劃出主軸製程的 MES，涵蓋有製程管控、生產報表與統計分析等三個模組。

『製程管控』模組除了管控製程品質與精度外，同時傳遞即時訊息給下一站，並且監控生產製程，依系統流程逐站往前推進。

『生產報表』模組提供列印出主軸的各部組立精度、測試報告等資料。無論是對內歸檔或隨機資料，都可經由系統隨時列印，不需再指派專人建檔列印，浪費人力、時間等。『統計分析』模組除了可提供管理者了解生產品質的狀況外，同時可藉由主軸損壞資訊的整合分析，找出製程中不良的參數，幫助管理者重新訂定新的製程精度參數，以提升主軸的品質，提高主軸運轉壽命。

本系統以標準製程為基礎，再依不同型式的主軸，可巧妙組合出自有的生產模組，形成自己的生產體系（圖 1），進而達到主軸生產模組彈性規劃的需求。

2>MES Concept for Spindle Production

The production for spindle covers three major stages; material preparation, assembly and testing. Among the stages, the stages of assembly and testing could be divided into more than ten sub-stages according to the different types of spindle. Among the important sub-stages, there are parts verification, clamping system assembly, shaft dynamic balance, assembly for front bearing set, assembly for back bearing set, full speed dynamic balance, power current testing, temperature-rising test, shaft eccentric measuring, dynamic run-out test, static rigidity, clamping and releasing tool testing and etc.These processes are highly related are relevantly coherent, and should be able to provide the producer of the next station with the real-time data, enabling the producer at the next station to do in-time correction or modification, or to find out the most suitable part to avoid the situation where poor quality will be discovered until the final stage of the process. If so, it would not only be a waste of time, but also possible of causing damage to the parts while re-dismantling the product.To solve these problems and to elaborate the efficiency of monitoring for the process, we present the MES for spindle process that would cover Process Monitor, Production report forms and the Statistic Analysis.

Besides monitoring the process quality and parts precision, Process Monitor will also pass over real-time message to the next production station, in the meantime, monitoring the production process by conducting system flow station to station.

Production report will provide print out of the data such as the assembly accuracy and testing report, etc.Whether for the purpose of internal document filing or for the machine document, the job can be printed at any time by the system, and there's no need to assign a personnel specifically for creating document or printing, to avoid wasting manpower and time.

Statistic Analysis, besides helping the supervisor to understand the situation of production quality, it could also find out the improper parameter standard from the process by the integrated analysis about the damaged spindle data. The supervisor, in this way, could re-set a new process tolerance parameter to improve the quality and prolonged the working life cycle of the spindle.

The system we present here allows the user, considering the different types of spindle, to masterly work out his/her own production module, based on the foundation of the standard process, to complete his/her own production system(Figure 1),then to reach a flexible application of the system.

3> 主要製程模組功能說明

本系統的製程模組很多，以下就其中的三個重要製程說明，以協助了解系統的運作邏輯。

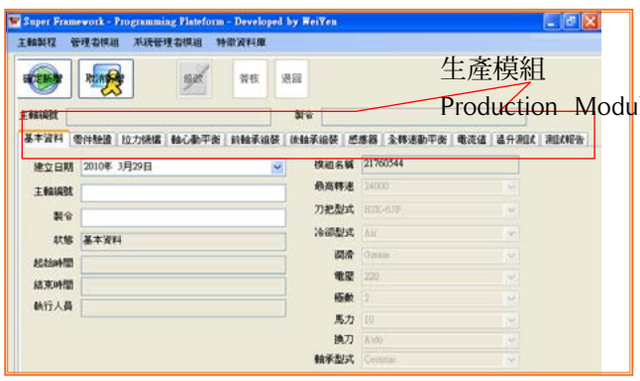


圖 1
(Figure 1)

a> 前軸承座組裝：

主軸在建立製程基本資料後，就會按系統設定的生產模組， 依序跑到各製程站別，生產者只要鍵入其生產權限的密碼，就能看到目前已推進到自己手中的主軸製令。以前軸承座組裝為例，有權限的生產者就會看到以下的畫面（圖 2），他可利用觸控螢幕的操作，將組裝時所量測的數值，由其站上的終端機輸入，系統會檢查製程精度是否符合標準值。生產人員在輸入完所有數據後，按簽核，系統自動計算主軸在此站組裝花了多少時間，隨同輸入的精度數值，自動往前推到下一站。

b> 軸心動平衡：

軸心動平衡是主軸關鍵的製程 需有經驗的生產人員來確實掌控平衡的調整。有權限的生產者才能進入以下的畫面（圖 3），同樣利用觸控螢幕的操控，將做好的動平衡數值填入，並按簽核，隨後系統將動平衡的工時與動平衡量一起記錄到系統資料庫，同時製程也往前再推到下一站。資料庫中的所紀錄的動平衡值，將與後製程中的全轉速動平衡，一起提供綜合分析，以了解過程中拉刀系統對主軸動平衡的影響。

c> 溫升測試

溫升測試是主軸生產中，重要的測試製程。每支主軸在組立完後 都必須做溫升跑合程序，負責此製程的人員

在執行完跑合系統後，將所完成的溫升資料載入 MES 系統，MES 系統即以圖表呈現（圖 4）。此溫升資料將提供分析溫升與幾何精度的關係。

圖 2 (Figure 2)

3> Explanation for the Major Process Module Functions

There are many process modules in the system; and the explanation for the three important processes will be shown below, to offer a better understanding about the operation logic of the system.

a> Assembly for the Front Bearing Set:

After being established with the basic process data, the spindle will be conducted to each process station according to the production module set up by the system. The producer will find the spindle manufacture order only by keying in his/her own production authorization code.Take the assembly of the front bearing set as an example, the authorized producer will be able to see the following screen (Figure 2). He/she, by operating the touch panel, and keys in the measured data during the assembly at his/her terminal, then, the system will check out if the process precision meets the standard value or not. Producer will, after keying in all the data, click the button for approving; and then the system will calculate by itself the time consumed for the assembly of the spindle at the station. Therefore, together with the inputted data, the working time will be recorded into the database in the system, and the process will move automatically towards the next station.

b> Shaft Dynamic Balance

Shaft Dynamic Balance is a critical process for the spindle; it requires the experienced production personnel to precisely control the adjustment of the balance. Only an authorized producer will be allowed to enter the following screen (Figure 3), with the same step, he/she will, by operating the touch panel, fill in the completed dynamic balance value, then click the button for approving; then, the system will record the working time and the value of dynamic balance in the system altogether. In the meantime, the process will move toward the next station. The dynamic balance value in the database will be analyzed, together with the full speed dynamic balance in the backend process,

to understand the influence of the clamping and releasing tool system over the spindle.

c>Temperature-Rising Test

Temperature-rising test is an important test process during the spindle production.After assembly, each spindle shall be tested with a temperature-rising run-in procedure, after completing the run-in of the spindle the producer in charge of this process shall key the measured temperature data in MES. MES will then present the result with the chart (Figure 4).The temperature-rising data will provide the analysis of the relation between the temperature-rising and the precision of the shaft.

圖 3 (Figure3)

4> 結論

主軸的生產除了靠嚴格的生產管制外，更重要的是，如何累積組立經驗，找出最適當的精度組合關係，特別是高速內藏式主軸，在高速、振動、溫升等嚴格要求下，其組立精度的配合關係，更是製程中最要那拿捏的關鍵。本系統的建立，除了幫助生產管理者，管控生產製程外，更重要的是透過統計分析，找出每一種主軸最佳的精度參數，來不斷的提升主軸品質。目前系統的建置已到了最後測試階段，時程上預計 5 月正式上線，對於 MES 製程管控有興趣的伙伴，屆時歡迎到主軸廠一同研究，本系統的順利推動，除感謝主軸廠同仁鼎力相助外，更重要的核心推手，是台大機械所博士班的 林威延先生，透過他的專業與深厚的程式撰寫功力，讓大家的夢想得以實現。

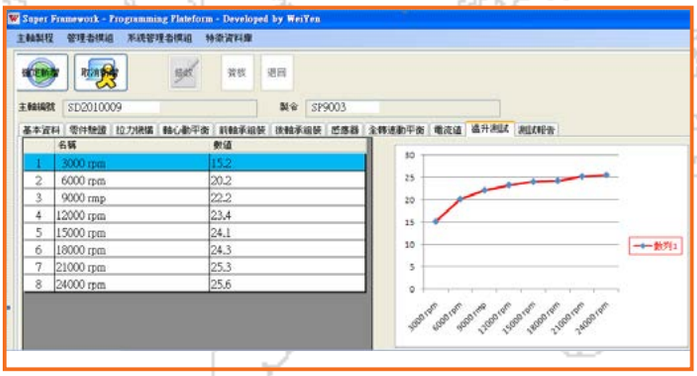


圖4 (Figure 4)

4>Conclusion

The production for the spindle, besides depending upon the strict production control, is far more important to know how to accumulate the assembly experience, to figure out the most proper precision assembly relation, especially for the high-speed build-in spindle. Under the tough demand of high-speed, vibration, temperature-rising and etc, the matching relation of assembly precision will be the most important key for the process.The establishment of the system is not only to aid the production supervisor for monitoring the production process, but also, more importantly, to figure out the best tolerance parameter for each type of spindle by statistic analysis, to continuously improving the quality of the spindle. At present, the establishment for MES had reached its final test stage, and is scheduled to be officially introduced into the production line in May. We welcome all the partners who are interested in the MES system to study together at the spindle manufacture factory. For the smooth implementation of the system, besides thanks to all the colleagues in the spindle factory, we would like to thank Mr. Lin Wei-yan, PhD mechanical institute of National Taiwan University, for his expertise and his professional programming capability to make our dream come true.

朱凌煜 from Sogotech

2010年東勢新丁粄節
Sin-Den-Ban Festival in Tungshih, 2010

台中縣東勢鎮新丁粄節比賽，具有歷史傳統民俗特色活動，每年固定在元宵節舉辦，流傳了100多年，是全省獨一無二的賽會，溫馨、有人情味。身為東勢人的我，剛結婚那一年也有參加，感覺很新鮮也很有趣，在廟口送粄給親友時，還會不斷的收到親友的祝福要我好好加油!

The sin-den-ban festival competition held in Tungshih of Taichung County is an historical, traditional activity with folk features, which held on lantern festival every year regularly, and had been sustained for more than 100 years. It is a one of a kind festival with warmth and friendliness in the country.

As a resident of Tungshih, I participated the festival in the year when I just got married, which was a refreshing and interesting experience. I received blessings one after another from relatives and friends when giving them “ban” at the entrance of temple, which they encouraged me to work hard.

「新丁粄」乃源自農業社會需要男丁，除了傳宗接代外，更是傳統農家勞動力的最大來源。因此，家裡前一年生有男丁的人，一定不會忘了在元宵節（天官賜福的上元節）時準備數十塊「紅粄」(上有象徵長壽的大龜印記，所以又稱紅龜粄)，到神廟謝神並祈福，祭拜後分享親友共沾喜氣。

東勢鎮各個里的媽媽教室用＂糯米＂及＂粄＂所做出的造型虎，還可以參加比賽，可愛的巧虎造型軟化了大家對可怕兇老虎的刻板印象

The origin of “sin-den-ban” is the agricultural society which required male members, not only for carry on the family line, but also for obtaining the main workforce of traditional peasant family. Therefore, for the family which had new male members in the last year, they will prepare dozens of “red ban” (with the giant tortoise symbol for long life on it, therefore, it also called red tortoise ban) to worship gods in the temple and pray for blessings on lantern festival (also called Yuan Shang Festival, the Deity of Heavens will give blessings to people on this day), then give “bans” to relatives and friends after worshiping to spread their happiness and luck.

The mother’s studio of each neighborhood in Tungshih had designed tiger patterns made of “glutinous rice” and “ban” to participate a competition. The cute chiao-hu design had softened the stereotype of fierce tiger.

今年的吉祥物（虎）
The mascot of this year (tiger

"福虎送新丁"也很可愛
「Lucky Tiger brings New Boy」is also cute

最後就是我們參加新丁粄節後老天爺給的禮物
（雖然穿粉紅色但我是男生喔）

Lastly, is the gift god gave us after we participated the sin-den-ban festival (Although in pink, I am in fact a boy!)

大象 Elephent from AIC

2009 鐵馬環島之旅（上）

2009 Bicycle Touring around Taiwan (1)

2009年01月24日 星期六 第一天
後龍->淡水(134.9 Km)

Day 1 Houlong -> Danshui (134.9km) Saturday, January 24th 2009

清晨 4 點多就醒了，不知是否太高興了，超興奮的心情喚醒了我。計畫了好久的環島旅行，這一天終於到來！還好，並沒有下大雨，也沒有颱風！出發前的幾天，每天都緊盯著氣象報告，還好，小年夜時只有寒流來襲。小小的寒流無法阻止我完成這個計畫！

行李在前一天晚上，就已經大致打包好了，現在只需將它固定在腳踏車上一切準備就緒，回到媽媽家吃個早餐，事先已跟媽媽溝通過了，將準備好的紅包交給媽媽後，出發了！

I woke up a little past four o'clock. Maybe it was the happy mood and the excitement that woke me up. The bicycle touring around Taiwan was finally here! I was lucky because there was no pouring rain. Neither was there a typhoon! During the few days before I set out, I had been following closely on the weather report. Fortunately, during the day before the Chinese New Year's Eve, there was only a cold front hitting Taiwan. A tiny cold front like this could not stop me from accomplishing my plan!

之前規劃路線時就考慮到「東北季風」，所以才規劃「順時針」環島路線，沒想到，東北季風竟超出我想像，嘿嘿，不過我並不會退縮的，出發囉！

車行至鳳鼻隧道時變速好像變得怪怪的，停下車檢查，發現整個齒盤脫落。還好 Eric 夠朋友，飛車來救我，不然，環島計畫就告吹了！修好車後已中午 12 點了，原本想請 Eric 吃個飯，但行程已拖延太多，環島結束後再請 Eric 吃飯吧！

I almost finished packing on the last night. Now I only had to load the luggage onto my bicycle before I could set out. I went home and had breakfast with my mother. I told her about this plan in advance. Having handed her the red envelope I prepared for her, I set out on the tour!

When I was planning the route, I took into consideration the northeast monsoon. Therefore, my tour around Taiwan started clockwise. To my surprise, the Northeast monsoon was beyond my imagination. But guess what, this was nothing to scare me off. Let's go!

I felt that my bicycle was not doing well when I traveled to the Fengbi

東北季風沒有因為我的腳踏車出了狀況而放過我一馬，還變本加厲的加強了它的風速，我今天一定會騎到淡水的，雖然會晚了點，還好我有帶登山大衣，外面的溫度據 Eric 所言，只有10℃，真是嚴酷的考驗。今晚的星星都跑去躲起來了，是因為太冷了嗎？黑鴉鴉的台 15 線上只剩下我的車燈，果然還是免不了要夜騎，還好我裝三個車燈，夠亮可以照亮前方的馬路，不然一個沒注意可能騎到海裡。

晚上八點多，終於來到了關渡大橋，雖然我左腳已經在痛，但是再一下下就到旅社了，還好我有帶著朋友給的貼布及肌樂，感謝我的朋友！

一晚八百元，在台北應該是很舊很舊的旅社，不過一個人的單車旅行，要求不高，有個地方可遮風避雨、可以洗熱水澡、有床可以躺，那就心滿意足了。

2009年01月25日 星期日(除夕)
第二天　淡水->福隆(115.67 Km)

經過一個晚上斷斷續續的休養，早上不到五點就起來了，整理好行囊後繼續往下一個目的地－貢寮福隆出發。再見囉！淡水～

昨晚住宿的新五福旅社大廳位在二樓，必須將腳踏車扛上去，而且還需經過一條狹窄的通道，真佩服自己昨晚是哪來的力氣將腳踏車扛上樓的。早上出發時才發現旅社原來是在市場內，台北的市場跟鄉下地沒啥不同，忙於作生意的小販一大早就出現了，當自己牽著

直的看我瞧。穿過了熱鬧喧囂的市場，出巷子後緊接著台 2 線，福隆，正等著我呢！

沿台 2 線朝福隆前進，騎著騎著，咦～怎不見台 2 線指標呢？拿出地圖對照，原來要走登輝大道再接台 2 線啦！但是，登輝大道呢？亂竄了一陣子，終於讓我找到登輝大道。雖然找到登輝大道，但台 2 線的指標呢？依然迷路中！照舊亂竄了一陣子，也耗費了一些時間，終於回到了台 2 線了，加油～福隆，我來了！

當準備拍照將相機電源打開，將按鈕切換至拍照模式，咦！怎是攝影模式咧！將電源關掉，再開一次，哇～還是一樣！不死心地試了 N 次，結果還是一樣，這麼好運，第二天也中獎，只好將就使用攝影模式吧！到野柳後，連攝影模式也掛了，沒辦法，晚上再打給 Eric，看看是啥麼狀況吧！

Tunnel. I stopped to check if everything was all right and found that the whole sprocket of my bicycle slipped off. Thanks to Eric, my friend who rushed to my rescue, I was able to go on with the plan to tour around Taiwan. It was nearly 12:00 by the time the bicycle was fixed. I was going to buy Eric lunch but since my itinerary had been delayed by too much, I decided to put that on a rain check with Eric.

The northeast monsoon did not give me a break for the incident that happened to my bicycle. Instead, the gusts became more and more intense. I said to myself that I would make it to Danshui no matter how late it would be. Fortunately, I brought my mountain-climbing coat. According to Eric, the temperature outside was only 10℃. It was really an ordeal for me.

There was no star tonight. I bet they were hiding because it's too cold. On Tai Route 15, I could only see the light of my bicycle amid complete darkness. I figured that it would be inevitable that I had to ride during nighttime, and felt fortunate to had three lamps installed on my bicycle. The lamps were bright enough to light up the road ahead of me. Otherwise, any slip of attention can have me end up in the sea.

It was a little past 8 at night that I finally arrived at the Guandu Bridge. My left leg was hurting already but I had to hang on until I arrive at the hostel. Fortunately, I brought with me patches and muscle relaxants prepared by my thoughtful friend. I was grateful!

It cost me eight hundred to stay a night at the hostel. It shall be a very old hostel in Taipei, which perfect suited the simple needs of a single traveler like me for a place to stay away from the rain, take a hot shower, and lie down on the bed. I was very contented.

Day 2 Danshui -> Fulong (115.67km) Sunday (Chinese New Year's Eve) January 25th 2009

Though not steady, after a night's rest, I got up a little before 5 o'clock in the morning. Having packed up, I continued with my tour toward the next stop, Gongliao Fulong. Goodbye! Danshui~

The lobby of the Xinwufu Hostel I stayed at was on the second floor so I needed to carry my bicycle all the way up the second floor and went through a narrow corridor. I had to admire myself for being able to carry the bicycle upstairs despite the little strength I had left. When I was setting

2009年01月26日
星期一(初一)
第三天
福隆->太魯閣
(166.03 Km)

昨天下午抵達福隆時，就開始下起了毛毛雨了，大東旅社位於福隆車站的街上，比起昨晚住宿的品質好太多了！印象中，這裡每年都會舉辦音樂季，上次來這已是前年的事了，不過不是來參加音樂季，而是跨年的回程路過此地吃早餐。

起床時，隱隱約約聽到滴滴答答的雨聲，還在下雨，聽起來應該比毛毛細雨大了一些，還好我有準備雨衣跟雨褲！第三天的旅程看來是要體驗一下雨天騎鐵馬的滋味了！

進入宜蘭市後出太陽了耶，太棒了！去拉拉山玩的時候曾經來過羅東，記得它有一座超大的公園。打從爬坡開始，一路上都是塞車、塞車、塞車，除了塞車還是塞車。還好我是騎腳車。開始進入蘇花公路後，只有騎過後你才知道蘇花公路的考驗。

從爬坡開始，沿路上都會有加油的聲音，碰巧的是，也有其他的車友一起接受蘇花的考驗，一起加油吧！蘇花公路的景色真的很美，這是開車所無法體驗的。而且幸運的是，因遇過年期間，所以砂石車大哥們都休假去囉！

第一個坡的高點整整花了一個小時，真是大挑戰啊！沒想到接下來還有二個。爬第二個坡時，下起了毛毛雨，但景色超優的，一邊爬坡一邊欣賞海景，讚啦！

太晚進入蘇花公路，此時太陽已要下山了，還好都是小客車，沒有傳說中的砂石車。經過以上的長坡後終於不用再爬長坡了。但，騎過才知道，綿延的隧道群有 4 公里之長。在狹窄的隧道內，曾聽車友提及，有車友整個人貼著牆壁才能閃避砂石車，如此恐怖的經驗，我一點都不想要啊！更何況是晚上啊！夜騎蘇花海景當然看不到啦！

今天騎了 166.03 公里，又超出預期的里程，還好，體能狀況不錯！只是騎完蘇花公路後，我的 2 隻腳傷～

這次環島的旅程特意安排了一天到太魯閣，自從上次在

out, I found that the hostel was located in a traditional market. The market in Taipei had no difference from that in the countryside. The vendors busied for their dealing certainly showed up early in the morning. When I walked with my bicycle through the market, there were around seven to eight pairs of eyes staring at me. At the end of the noisy and busy market, it was Tai Route 2 which shown up after I went through the alley. Fulong, here I come!

I rode along Tai Route 2 toward Fulong. After a while, I became aware that there was no sign that said Tai Route 2. I took out my map. There you go! I had to go on the Denghui Boulevard before I could reach Tai Route 2. But, where is the Denghui Boulevard? I was exploring for quite some time and finally found the Denghui Boulevard. Now I had found the Denghui Boulevard, but where was the sign for Tai Route 2? I was still lost! Again, I was exploring for quite some time and wasted the same amount of time. Finally, I was back on track on Tai Route 2. Hang on, Fulong! Here I came!

I was getting ready to take pictures so I turned on the camera power and switched to the picture-taking mode, but it was the videotaping mode that went on! Try again. I turned off the power and turned it on again. Same thing! I kept on trying as many times as you could imagine and got the same result again and again. The same thing happened the second day. All right, then, I would just use the videotaping mode! By the time I arrived at Yeliu, the videotaping mode died, too. I could not think of a solution so I called Eric again at night to see if he could help me with troubleshooting!

Day 3 Fulong -> Taroko (166.03km) Monday (Day 1 of the Chinese New Year), January 26th 2009

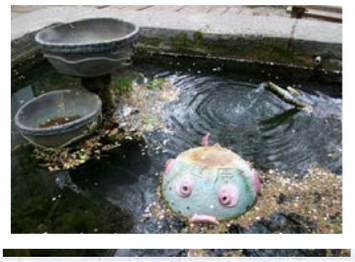
2009年01月27日星期二(初二)
第四天 太魯閣(71.40 Km)

「看公視說英文」節目裡介紹此地，心想若能騎腳踏車逛太魯閣，那一定很棒！

騎著鐵馬，穿梭在這如此的美景，馬路就在岩壁裡，路旁就是溪谷。騎腳踏車的好處就隨時隨地都可停下來，好好欣賞這大自然鬼斧神工的美景。

燕子口就比較多遊客了，過年期間這兒湧進大量的遊客，也實施了交管；慶幸我是騎腳踏車。燕子口偶爾瞧見 2~3 隻燕子，但溪谷旁的山壁不時傳來燕子的聲音，似乎也在歡迎我這遠從苗栗來的騎士。騎到西寶時，已接近中午了，此時發現這兒居然有個國小耶（當地人說它很有名哦）！

今天的旅程很不一樣，前幾天看滿多的海景，今天就換點口味吧！來點山壁、溪谷、森林小學，今天騎的不遠，只有 71. 4 公里。



It started to drizzle by the time I arrived at Fulong last night. The Dadong Hostel was located on the same street as the Fulong Station. The quality of the environment was much better than the previous night's. I remembered that this was where the music festival was held each year. The last time I visited here was two years ago. I did not come for the music festival but to have breakfast on the way back home from the year countdown event.

When I got off bed, I seemed to hear the dripping sound of rain. It was still raining and sounded a little heavier than a drizzle. Fortunately I had the raincoat and pants ready! On the third day of the tour I was ready to experience a bicycle ride in the rain!

The sun came out after I entered Yilan City. It was great! I dropped in at Luodong once during the trip to the La La Mountain. I remembered that there was a huge park. On the way up the slope, there was a big traffic jam. All one could see were cars and cars lined up one after another on the road. I felt lucky that I was riding a bicycle. The challenge did not really begin until I went on the Suhua Highway. You will not know how hard the task is before you took the ride.

Right after I went up the slope, I could hear cheers for me along the way. It happened that there were other bicyclists challenging the Suhua Highway, too. We cheered for each other!

The views along the Suhua Highway were magnificent. This was something that one could not experience when driving a car. What was more fortunate was that the biggest threat on the road, the sand trucks, were all on the Chinese New Year Vocation.

It took me a whole hour to reach the peak of the first slope. What a challenge! After that, there came the second slope. When I was going up the second slope, it started to drizzle but the views were great. I was conquering the slope and at the same time, appreciating the beautiful views of the sea. Great!

I entered the Suhua Highway too late and the sun was ready to set. Fortunately, there were only sedans on the road. There were no scary sand trucks. After long slopes one after another, I finally did not have to go up any more slopes. I did not know until later that the tunnels added to 4 kilometers in length. I heard other bicyclists say that some bicyclists had to lean against the wall to avoid sand trucks when they rode inside the narrow tunnels. I did not want to experience that at all, speak alone at night! Of course, you see no ocean views when riding at night!

Day 4 Taroko (71.40km) Tuesday (Day 2 of the Chinese New Year), January 27th 2009

I especially arranged one day to Taroko during this tour around Taiwan. Since I watched the program "Learn to Speak English with Public Television" introducing this place last time, I had been hoping to visit Taroko by bicycle. It would be great!

I rode my bicycle through the beautiful views. The road is built inside the stone wall, and next to the road is the valley. One advantage with riding a bicycle was that I could stop at any time to appreciate the magnificent work of God.

There were more tourists at the Swallow's Grotto. Tourists fluxed into this place during the Chinese New Year vacation and there was traffic control. Again, I felt I was lucky for riding a bicycle. I could occasionally spot two to three swallows and heard constant swallow chirps that came from the stone walls by the valley. It seemed that they were welcoming me, the bicyclist who came all the way from Miaoli.

By the time I arrived at Xibao, it was nearly noon. I was surprised to see an elementary school there (and a famous one, according to local people).

The trip today was very different. I saw quite a few ocean views in the past couple days and it's time for something different. I saw the stone walls, the valley, and the forest elementary school. I did not ride a long distance today, which was only 71.4 kilometers.

恩德園地
ANDERSON FIELD

保齡球大賽 *Bowling Competition March 5th, 2010*

涂慶榜 from AIC

每年一季的兩個活動確實讓人傷腦筋，忙完了旺年會，再張羅一個春酒，接下來就要思考要辦那兩個活動了。平常在一起中午用餐的小豬（朱）看我悶悶不樂 食不下嚥(有那麼嚴重嗎？)，馬上就散發出樂天的本性 建議我就辦個保齡球比賽吧！(哈哈…我怎麼不知道她是去年的女子組的冠軍，又想要來撈錢了，老步數！想想也好，畢竟每次辦保齡球比賽，同仁報名都非常的踴躍。

果然日期確定後一公佈，報名的電話就響個不停，真是一個熱門的活動（看起來每年固定辦一次也不錯！）。3 月 5 日一下班我就飛快趕到竹南擱再來包子店去拿包子，這家包子店是苗栗縣最有名的，每次去都要排隊好久才買得到，還好昨天就先預訂了，所以沒花很多時間排隊，到了球館已經有一些同仁先到了，經與店家討論球道分配情形及注意事項後，同仁也陸陸續續到齊了，7 時一到我們就正式開始比賽。經過一晚的廝殺最後成績如下：

It really took hard efforts for arranging the two recreation activities for the employees scheduled in every quarter of the year. After preparing the year-end party and the " Spring Drinking" party for greeting the arrival of spring, it was the time for organizing those two activities. Ms. Chu (also nicknamed as Piggy) who had lunch with me in the canteen for almost every working day, when finding the problem which bothered me so much and making me unable to enjoy the lunch (that serious?), instantly shared me with her cheerfulness and proposed me to arrange a bowling competition. (Ha ha, I understood that she was the champion of the female group for the bowling game last year, and now she was making the chance and came out this old trick, trying to make some fortune for herself , right?) Not bad for the idea, after all, the game was always popular and attracting lot of attendees to the occasion once we had prepared the game.

Really, the phone calls from the colleagues kept coming in for registration of attending the game, after the date of the game was announced. It was, indeed, a popular activity to the employees. (It seemed to be a good idea to hold the bowling game as a regular activity for every year.) Right after work on March 5th, I rushed to pick up the buns at " Keeping-Coming-Back Steamed Buns with Stuffing Shop", the shop has been the most famous for their buns in MiaoLi County. Usually, you had to line up for a while to buy the buns. As ordered the buns in advance yesterday, it did not take me much time for the pick-up. Once in the bowling club, I found some of the colleagues had already got there. After checking with the club people about the lanes allocated for competition and the attention items of the club, we officially started the game at 7 o'clock when all the attendees were there finally. After a night of competition, , the result coming out as:

男子組 Male Group:

第一名 品保部 鄭錫欽 總分495
First Place: QA, Cheng Shi-ching, Score: 495

第二名 電子機械廠 鍾文達 總分476
Second Place: Electronic-Mechanic Factory, Chong Wen-da, Score: 476

第三名 精密機械廠 黃源鑫 總分475
Third Place: Precision- Mechanic Factory, Huang Yuan-sing, Score: 475

女子組Female Group:

第一名 品保部 林秋華 總分394
First Place: QA, Lin Chiou-hua, Score: 394

第二名 業務部 李秀萱 總分333
Second Place: Sales, Li Shao-shuan, Score: 333

第三名 採購部 朱蘭結 總分322
Third Place: Purchase, Chu Lang-jie, Score: 322

男女PK賽PK Competition for Male and Female Group

第一名 黃源鑫+劉玉芳
First Place: Huang Yuan-sing + Liu Yu-fang

第二名 吳智忠+朱蘭結
Second Place: Wu Chi-chong + Chu Lang-jie

在此也恭喜以上獲勝的同仁。這次的保齡球比賽值得一提的是，男子組的第一名比上次的第一名進步了有42分之多，期待下次會有更好的成績出現。

Congratulation to all of the colleagues listed above for winning the prizes.

One thing worthy sharing here with everybody was that the score of the first place for the Male Group this year got better performance by 42 points than that from the game last year. We expected better scores will be coming out in the game next time.

後龍工廠 麻將友誼賽

Friendship Mahjong Competition in HoLong Factory

三月二十六日，4:40 下班後即從餐廳中不斷傳出熱鬧的聲音，來到餐廳一看，原來是眾人期待已久的麻將友誼賽開鑼了。

麻將果真不愧是華人世界最受歡迎的益智遊戲，打從涂副理發出公告沒多久，報名的電話就不斷湧入，甚至在比賽前一天都還有人要報名。最後，比賽當天竟有十七組人馬參與，參與人數可比之前舉辦保齡球比賽踴躍太多了，沒想到最後竟然連楊副總、崔副總也都報名參與了。

一到餐廳，除了看到眾多高手絲毫不需思考，出手俐落的出牌外，在現場也看到不少像新手的參與者，理牌慢、出牌也慢，真是好不令人納悶，這些人為什麼會來參加友誼賽呢。等到 PIZZA 出現，見眾人一擁而上，大聲吆喝，這才恍然大悟，原來有些參加者還真是醉翁之意不在酒，目的只是純粹交友聊天罷了！

時間就在大家邊聊天邊打牌的快樂氣氛中飛逝，轉眼間已到八點多，就在大部份的人都離開後，仍有些人似乎好不容易才找到牌搭子，仍眷戀著不肯離開呢！

At 4:40PM, March 26, lively noise coming from the canteen, when taking a look at the site, people found that it was the beginning for the friendship Mahjong competition that everybody had expected for such a long time.

Mahjong has really been the most popular puzzle game for all of the Chinese over the world. The friendship competition was so popular that since the announcement made by Vice Manager Tu, phone calls for registering to attend the game kept coming in, and even, on the day before the competition, there was still people kept calling for registration.

In the end, the number of the attendees amazingly reached 17 teams for the game. The number was far more than the bowling game held before; beyond our expectation, even Vice president Yang and Vice President Choi also attended the game.

In the canteen, besides the experienced players who played sharp and without hesitation; there were also many players who seemed to be the beginner of the game, slow at arranging the Mahjong chips and hesitate at showing out the chips, it made people wonder why these inexperienced players would attend the game.

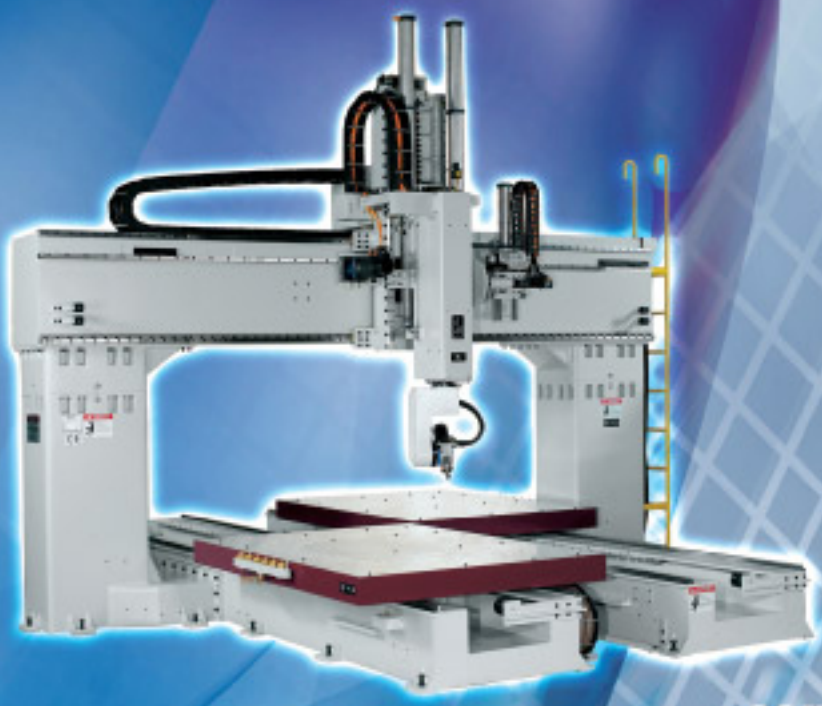
People found the answer to this question finally when Pizza was served on the table; all of the people shouted excitedly and rushed to the table for a piece of the delicious food. So, just like the old saying goes, “The drinker’s heart is not in the cup.”, the real intention for the attendees was not for the game, but just for the occasion of socializing and mixing around with the people for friendship from the game.

Time flew by quickly in a happy atmosphere, when people playing the game and chatting with one another. When around 8 o’clock in the night, and most of the people have already left from the canteen, there were still some of the people who were reluctant to stop playing because they just got the sufficient number of persons for playmates to play the game.

恩德科技集團

ANDERSON GROUP

ANDI
ANDERSON GROUP



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