Motion Control Systems
運動控制核心系統

產品及產業化 Product And Industrialization

全數位軟體運動控制平台

EtherCAT Motion Control Platform-Softmotion (EMP-S)

簡介 Introductions

EMP-S 以 EtherCAT 通訊作為基礎，使用者透過乙太網路傳送資料封包至 EtherCAT 從站 (例如：伺服驅動器、周邊 I/O 模組) 進行資料交換，在通訊架構上為分散式時脈 (DC)，提供一相容於 EtherCAT 通訊協定的運動控制函式庫 (MCCL)，可以讓驅動器及 I/O 模組的命令更新週期達到 250 μs，保證各從站間同步誤差小於 1 μs；有別於傳統運動控制系統，EMP-S 不需額外的硬體，只需透過標準網路卡即具備多軸運動控制能力，並在配線上具有彈性及靈活等優勢。

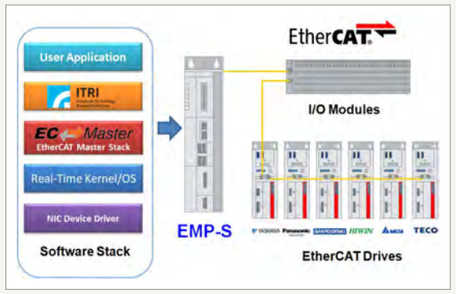
The EMP-S is based on the Ethernet for Control Automation Technology (EtherCAT) communication protocol. The EtherCAT master motion control command library (MCCL) sends the command data as packets through the Ethernet network to the EtherCAT slaves (such as servo drives and IO modules), which respond with feedback data via the same network. Distributed Clocks (DC) are used in the communication layer, allowing the servo driver and the IO modules to reach 250 μs updating command cycles. For high-precision synchronization applications, it has been verified a synchronization delay of less than 1 μs. Unlike traditional motion control systems, the EMP-S neglects additional hardware, yet remains capable of running multi-axis motion control via a standardized network. One of the main advantages of the EMP-S is its wiring flexibility.

特色與創新 Features and Innovations

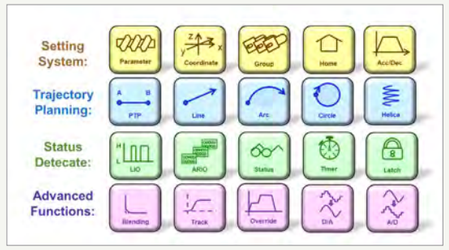
- 支援 EtherCAT 通訊控制伺服驅動器、I/O 模組。
- 支援多軸同動運動命令路徑規劃。
- 支援關節型機器手臂軌跡規劃。
- Supports EtherCAT control servo drive, and I/O module.
- Supports multi-axis simultaneous motion path planning.
- Supports articulated robot arm trajectory planning.

應用與效益 Applications and Benefits

- 全數位網路多軸精密伺服控制。
- 高響應及高效能的工業控制產業。
- Digital multi-axis high-precision servo control.
- High-response and high-efficiency in industrial control.



全數位運動控制平台架構
EtherCAT Motion Control Platform-Softmotion (EMP-S) Structure



運動控制函式庫 Motion Control Command Library(MCCL)

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智慧型運動控制平台

Intelligent Motion Control Platform (IMP-3)

簡介 Introductions

IMP-3 內建微處理器 (Dual-core ARM Cortex-A9)，具 8 軸伺服馬達開迴路或閉迴路同動控制能力，提供硬體 PID 與 FeedForward 位置閉迴路控制法則，解決追隨誤差與穩態誤差問題；亦可選配硬體 3D 編碼計數器比較栓鎖值與龍門雙軸跟隨誤差補償功能。位置閉迴路控制採用 PID 控制法則，以 -10V 至 10V 之速度命令驅動；在脈波輸出控制，可讀回馬達編碼器值。

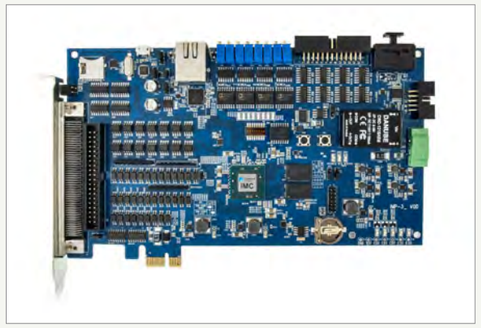
Every IMP-3 has a built-in microprocessor (Dual-core ARM Cortex-A9), and supports synchronous motion control of up to 8 servo motors for either open-loop or closed-loop. It also provides hardware-based PID, feed-forward closed-loop control algorithms, 3D encoder compare latch function, synchronous gantry tracking error compensation, PID closed-loop control using -10V to 10V range command speed, and, in pulse mode, the encoder value can be read. Furthermore, it also provides a servo control interface that allows users to design their own motion command control algorithm.

特色與創新 Features and Innovations

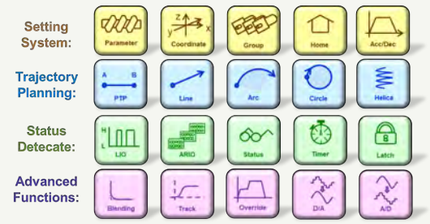
- 提供軟體伺服控制介面。
- 支援硬體 3D 編碼計數器比較栓鎖值功能。
- 支援龍門同動控制。
- 支援多軸同動運動軌跡規劃。
- 支援關節型機器手臂軌跡規劃。
- Provides servo control interface.
- Supports 3D encoder compare latch function.
- Supports synchronous gantry control.
- Supports multi-axis synchronous motion trajectory planning.
- Supports articulated robot arm trajectory planning.

應用與效益 Applications and Benefits

- 多軸精密伺服控制。
- 步進馬達或伺服馬達控制。
- Multi-axis precision servo control.
- Stepping motor or servo motor control.



智慧型運動控制平台
Intelligent Motion Control Platform (IMP-3)



運動控制函式庫
Motion Control Command Library (MCCL)

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超音波控制器

Ultrasonic Controller

簡介 Introductions

工研院機械所開發之 4 kW 20 kHz 智慧型數位式超音波控制器 UW-20，具自動頻率補償及振幅控制功能，無須搭配特定廠牌震盪子，即可達到自動搜尋操作頻率功能。

The 4 kW 20 kZ Intelligent Digital Ultrasonic Controller (UW-20) developed by ITRI features automatic frequency compensation and amplitude control function that is compatible with any brand of ultrasonic oscillator (20 kHz). The UW-20 can automatically search operation frequency.

特色與創新 Features and Innovations

- UW-20 支援各廠牌 20 kHz 震盪子，透過匹配電路及控制邏輯修改，最高可支援 50 kHz 各式應用。
- 除最佳工作頻率自動鎖定外，亦可提供客製化功率曲線功能，以利高階熔接應用。
- 具上位控制器溝通介面，利於整合超音波系統。
- 提供低耗能及低噪音超音波加工解決方案。
- Supports 20 kHz ultrasonic oscillators and applications up to 50 kHz are available through impedance matching and control logic modification.
- For high-level welding applications, it supports customized power curve adjustment and optimum work frequency automatic lock function.
- Uses a host controller interface for the integration of ultrasonic systems.
- Low-energy and low-noise ultrasonic processing solutions.

超音波控制器
Ultrasonic Controller

應用與效益 Applications and Benefits

- 自動頻率補償提供精準電壓電流相位控制，節能達 10% 以上。同時免除停機手動調整頻率，可提升生產效率。
- UW-20 可應用於切削、研磨及清洗。透過驅動與傳電線圈頻率解耦，可提升無線傳電刀把效率達 50% 以上。
- 多種客製化熔接模式，加速塑膠熔接整機國產化。
- 透過電子元件性能提升，可達 5.5 kW 金屬焊等應用。
- Energy saving of up to 10%, improves production efficiency without manual adjustment required.
- UW-20 can be used in cutting, grinding and cleaning, with an efficiency of more than 50% by the frequency decoupling of the ultrasonic power transmission and ultrasonic drive for the wireless tool holder.
- Customized welding modes to accelerate domestic production of plastic welding machines.
- Provides up to 5.5 kW metal welding and other applications with performance improvement of electronic components.

超音波控制板
Ultrasonic Controller

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內藏直驅旋轉電機模組

Built-in Type Direct-drive Electric Motor Module

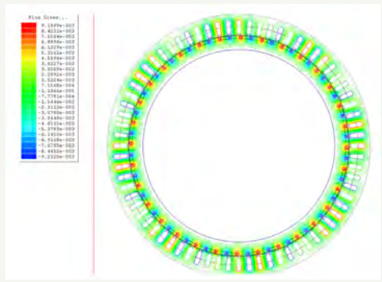
簡介 Introductions

本模組為內藏式電機，可與機構配合，直接驅動，透過優化的電機設計可產生高扭矩，降低轉矩漣波，不須經由皮帶或減速齒輪，無背隙問題，可提高加工機台響應速度與精準度，提升整體製程效率。

This module is a built-in motor which can cooperate with a mechanical mechanism. Through the optimized motor design, this motor can generate high torque, reduce torque ripple, achieve direct drive without belts or reduction gears, and has no backlash problems. It can improve the response speed and accuracy of the processing machine, and the overall process efficiency.

特色與創新 Features and Innovations

- 多樣轉子設計，提供表面貼與內藏式磁鐵。
- 透過有限元素軟體實現電磁分析與結構強健設計，達到最佳磁路設計與低轉矩漣波。
- 提供客製化服務整合生產製程製造鏈。
- Multiple rotor types, including surface-mounted and interior permanent magnet.
- Through finite-element software, electromagnetic analysis and structural design are carried out to achieve optimal magnetic circuit design and low torque ripple.

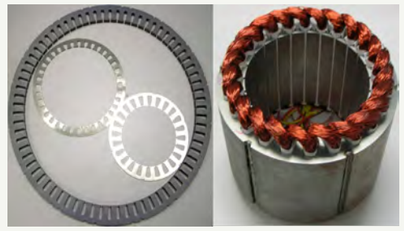


有限元素軟體電磁分析
Finite-element Electromagnetic Analysis

- Integrated supply chain for customized service.

應用與效益 Applications and Benefits

- CNC 五軸加工機與龍門、高速電梯、工業用機械手臂、旋轉工作台。
- 五軸加工機導入旋轉型兩軸頭，縮短加工時間、增加製程效率、降低成本，獲得高附加價值。
- CNC five-axis machine and gantry crane, high-speed elevator, industrial robot arms and rotary tables.
- Introducing two-axis rotary spin in a five-axis machines can shorten machining time, increase manufacturing efficiency, reduce costs and obtain high added value.



電機定子與繞線技術
Motor Stator and Winding

中空轉子與磁鐵設計
Hollow Rotor and Permanent Magnet

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