

具 IE4 效率感應馬達研製及無感測器交流馬達驅動系統研發

執行單位

南臺科技大學

計畫主持人

龔應時

● 內文

本計畫主要研發具**IE4**效率之感應馬達及無位置感測器感應馬達之驅動控制系統。所提系統能比現行工業用三相感應馬達及其驅動控制系統之運轉效率提升約**5%**，以達到節省工業能源之目標。

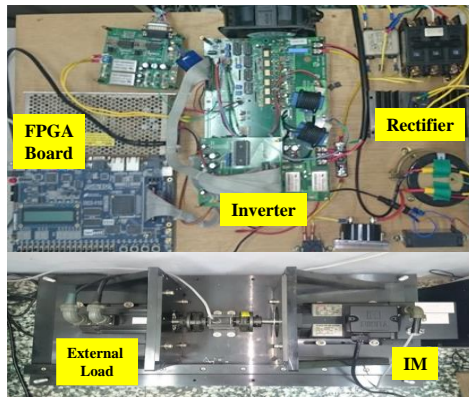


圖1. FPGA-based感應馬達
驅動控制系統



圖2. 具IE4效率感應馬達及
其電力分析

本計畫主要研發具**IE4**效率之感應馬達及無位置感測器感應馬達之驅動控制系統。主要針對**2HP**高效率感應馬達技術、感應馬達驅動控制與**FPGA**晶片化技術、三相雙向**AC/DC PFC**轉換器技術等，進行研究與製作實現。首先、本計畫進行符合**IE4** 效率規範之工業用先進感應馬達之研究，建立低成本設計分析及易製化之技術，探討多種馬達材料變化與成本及能效的分析。其次、本計畫以現場可程式邏輯晶片 (**FPGA**) 為基礎來研發交流馬達之驅動及速度控制技術。在實現上，速度控制器、電流向量控制器、轉速滑差及速度估測法則皆以硬體描述語言程式來發展此智財。接著、本計畫提出功率三相**PFC AC/DC**轉換器，以供給感應馬達功率驅動器之**DC**電源，當感應馬達功率驅動器操作於動力模式時，功率由**AC**端供給至感應馬達。最後、本計畫建構一套實驗系統，以證實所提**IE4**高效率感應馬達及驅動系統之有效性與正確性。本計畫所提系統將能比現行工業用三相感應馬達及其驅動控制系統之運轉效率提升約**5%**，以達到節省工業能源之目標。

Design and implementation of an IE4 efficiency induction motor and the development of sensorless ac motor drive system

Execution Unit

Southern Taiwan University of Science and Technology

Project Director

Ying-Shieh Kung

The project studies an IE4 efficiency induction motor and a sensorless ac motor drive system in the overall three-year project. Under the proposed design in IM and its drives system, the running efficiency can be increased about 5% for energy-saving than the convectional three-phase induction motor drives.

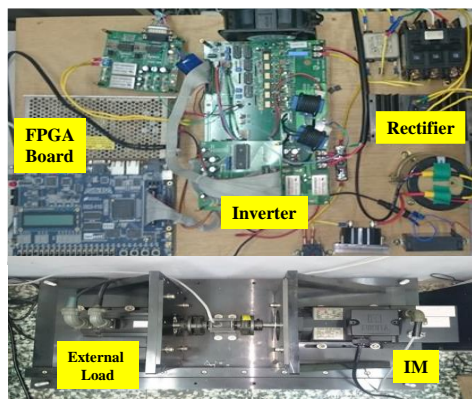


圖1. FPGA-based感應馬達
驅動控制系統



圖2. 具IE4效率感應馬達及
其電力分析

The project studies an IE4 efficiency induction motor and a sensorless ac motor drive system. Herein, we focus on the topic of a 2 HP high efficiency IM, FPGA-based motor drive system, three-phase AC/DC PFC converter etc. Firstly, the IE4 efficiency induction motors design and analysis technology for industrial applications in this project is established. Secondly, a speed controller for ac motor drive based on FPGA (Field programmable gate array) technology is developed. In realization, the IP (Intellectual Property) of the speed controller, current vector controller, speed slip and speed estimation algorithm are all developed by VHDL (Very-High-Speed IC Hardware Description Language). Thirdly, to provide induction motor drive DC source, a three-phase PFC AC/DC converter is proposed. The load of the DC/AC induction motor drive is regulated by the torque control mode and the speed control mode to drive the three-phase load induction motor. Finally, an experimental system is set up to verify the effectiveness and correctness of the proposed IE4 high efficiency induction motor and drive system. Under the proposed design in IM and its drives system, the running efficiency can be increased about 5% for energy-saving than the convectional three-phase induction motor drives.