國立清華大學第 4 屆傑出產學研究獎得獎人簡介

電機系吳財福教授

吳財福教授研究專長為電力電子，帶領跨校團隊執行第一期和第二期能源國家型計畫，近十年來深耕高功率(350 kW~1 MW)多功能轉換器的設計與製作，可廣泛應用於綠色能源發電、電池儲能、充電站充/放電、電動車馬達驅動、電子馬達模擬和能量回收，以及各種需要高功率交/直流電的場合。另外，吳教授致力於推動「交/直流諧和式微電網」，進一步提升綠色能源之使用效益和降低功耗；積極結合產業界開發直流供電之電器產品，建置示範辦公室，以及舉辦國際交流研討會，橋接國際專家，共同研發交/直流轉換器，提供國內產業參考。因應轉換器元件之非線性和非理性，吳教授開發「分切合整」直接數位控制，可涵蓋電流和電壓輸出型態，節省高功率轉換器元件成本約 20%，卻可讓轉換器更穩定操作；開發高功率 HIL 循環測試方法，可回收能源 90%以上。這些技術可以協助國內、外企業發展高功率轉換器系統，並可以達到節能減碳的目標，其影響深遠和貢獻顯著。

吳教授主持「精緻電力電子應用研究實驗室」，著重在轉換器拓樸結構、建模、控制，以及多功能轉換系統的研究，尤其提出「轉換器起源論」，透過轉化比擬機制，運用植物嫁接法、壓條法及 DNA 複製原理，有系統地推演轉換器拓樸結構，能夠將多位研究者花了近半世紀才試出來的轉換器，在 10 分鐘內就可以推演得到。吳教授目前擔任 IEEE Power Electronics Society“DC Microgrids Technical Thrust”之 Leader 和 Transactions 之 Associate Editor；曾獲得國科會/科技部兩次傑出研究獎，教育部「產學合作獎」，中國電機工程學會「傑出工程教授獎」及國內、外 7 篇最佳論文獎；曾主編 IEEE Transactions on Power Electronics in DC Distribution Systems 專刊。

Professor Tsai-Fu Wu received his Ph.D. from University of Illinois at Chicago. His research expertise is Power Electronics. He has led a team of 6 professors from different universities, conducting National Energy Projects (NEP) phase I and phase II for more than 7 years. In the latest 10 years, Prof. Wu is mainly focused on design and implementation of high-power (350 kW ~ 1 MW) multi-function converters, which can be widely applied to green power generation, energy storage, charging station, electric-vehicle motor driving, electronic motor emulation and energy recycling, and those which need high power conversion. In addition, Prof. Wu has promoted "Harmonized AC/DC Microgrids" worldwide, which can further raise effectiveness of green energy generation systems and reduce power loss. He works closely with industries to develop dc-supplied appliances, products and equipment, and builds a demo office at NTHU. Meanwhile, he hosts international forum and workshop on DC Microgrids, and bridges international experts to our local industries. To accommodate non-ideality and non-linearity of high-power components, he has developed division-summation (D-$\sum$) direct digital control. This control technique can be applied to current and voltage types of AC outputs, saving component cost around 20%, while operating converters with higher stability margin. Furthermore, he develops Hardware-In-the-Loop (HIL) power circulating test schemes, recycling energy higher than 90%. All of the developed techniques are useful to our high-power application industries to develop converter systems effectively, achieving the objective of energy saving and carbon reduction. It has profoundimpacts and significant contributions to our industries.

As the Director of Elegant Power Electronics Applied Research Lab (EPEARL), Prof. Wu guides his team towards researches on developing converter topologies, modeling and control, and multi-function converter system integration. In particular, he proposes the concept of "Origin of Converters", and through the mechanisms of analogy and transformation, converter topologies can be evolved systematically with graft and layer techniques and DNA replication principle.With these techniques, the well-known six PWM converters can be derived in 10 minutes, which were obtained by many researchers spending around ahalf century with trial-and-error approaches. Currently, Prof. Wu serves as the Leader of DC Microgrids Technical Thrust of IEEE Power Electronics Society and the Associate Editor of IEEE Transactions on Power Electronics. He received two Outstanding Research Awards from NSC/MOST, Industrial Co-op Research Award from MOE, Outstanding Engineering Professor Award from Chinese Electrical Engineering Society, 7 best paper awards from TaiPEA and International Conf. of PE Applications, and served as Editor-in Chief of a special issue of IEEE Trans. on PE in DC Distribution Systems.