PhD studentship (Full-time)

Institution	Xi'an Jiaotong-Liverpool University, China
Department	Department of Electrical and Electronic Engineering
Supervisors	Primary supervisor: Dr Huiqing Wen (Xi'an Jiaotong-Liverpool University) Co-supervisor: Dr Lin Jiang (University of Liverpool, UK); Prof. Moncef Tayahi (Xi'an Jiaotong-Liverpool University)
Application Deadline	Open until the position is filled
Funding Availability	Funded PhD project (world-wide students)
Project Title	Topology Studies and Efficiency Optimization of a Bidirectional Isolated Power Interface for Distributed Photovoltaic Power Systems considering Non-Ideal Parameters

Requirements:

Suitable candidates should be self-motivated and have excellent communication particularly reporting skills. Applicants with a BSc qualification equivalent to first honor degree or an MSc degree in power electronics, power conversion and circuits from an accredited university are welcomed. Applicants should have a strong electrical background and expertise on power electronic devices, circuits, topologies and control system. Applicants with the following field project experiences will be significant plus:

- Analysis and design of switching-mode power supply especially high frequency, high power-density resonant converter;
- Modelling and transient analysis of power semiconductor like MOSFET, IGBT, and IGCT;
- Design and optimization of magnetic components like transformer and inductor;
- Power electronics prototype PCB layout, DSP coding and debugging experiences, Prototype building and testing skills.

Supervision as well as resulting publications and thesis will be in English language. Successful graduates will receive a PhD degree from the University of Liverpool.

Degree:

The student will be awarded a PhD degree from the University of Liverpool (UK) upon successful completion of the program.

Funding:

The PhD studentship is available for three years subject to satisfactory progress by the student. The award covers tuition fees for three years (currently equivalent to RMB 80,000 per annum) and provides a monthly stipend of 3500 RMB as a contribution to living expenses. It also provides up to RMB 16,500 to allow participation at international conferences during the period of the award. It is a condition of the award that holders of XJTLU PhD scholarships carry out 300-500 hours of teaching assistance work per year. The scholarship holder is expected to carry out the major part of his or her research at XJTLU in Suzhou, China. However, he or she is eligible for a research study visit to the University of Liverpool of up to three months, if this is required by the project.

Project Description:

Distributed power systems (DPS) have been gaining attention recently. Bidirectional dc–dc converters are essential to accommodate the charge/discharge operations of energy storage systems and balance the power generation and load demands. Among various bidirectional isolated DC–DC topologies discussed before, the topology of Dual Active Bridge (DAB) has drawn significant attention for interfacing hybrid electric vehicle and fuel cells applications and showing advantages of bi-directional power flow capability, power controllability, and inherent soft switching.

DAB converters are usually controlled by the conventional phase-shift (CPS) technique. However, CPS might result in low conversion efficiency due to the loss of the soft-switching capability and producing high reactive power and circulating current flowing through the devices and transformer, especially when the voltage conversion ratio is different from unity. Furthermore, the non-ideal parameters such as power device voltage drops, driving delays and dead bands have a serious impact on the commutation transients and the efficiency optimization of the bidirectional isolated power interface in the whole operating power range.

The project aim is to develop a comprehensive analysis on reactive current formation and find an advanced strategy to achieve high efficiency for a wide operating range. The problems of phase-shift drifts, energy dead bands and the dc magnetic-bias, which are caused by the commutation transients of bi-directional converter, will be analyzed with aim to find appropriate compensation strategies. A mathematical model of power flow for different time-scales will be established and the methods to determine the optimal operating sub-mode will be analyzed.

Successful student will be trained in a highly innovative, interdisciplinary environment, with access to a range of state-of-the-art software, tools and experimental instrumentations. He/she can hope to develop into a highly skilled, independent power electronics researcher with broad knowledge of modern technologies and strong capabilities to solve engineering problems at the end of the study.