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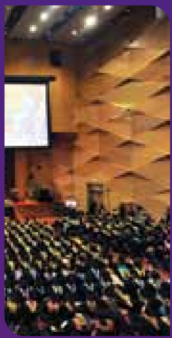

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Title : **Intelligent Sizing And Output Prediction Techniques For Grid-Connected Photovoltaic System**
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This thesis presents new intelligent-based techniques for sizing and output prediction in grid-connected photovoltaic (GCPV) system. Initially, two intuitive-based sizing algorithms for GCPV system design, termed as Conventional Sizing Algorithm (CSA), were developed based on two design goals. The design goal 1 (DG1) was formulated with the aim to design a system based on a specific solar electricity requirement while the design goal 2 (DG2) dealt with the sizing of the system such that maximum solar electricity can be generated using the available roof space. In addition, each CSA incorporated both technical and economic sizing procedures to provide comprehensive design using a pre-selected set of photovoltaic (PV) module and inverter. It was found that the maximum solar electricity requirement from CSA with DG1 was actually capped to the maximum solar electricity that can be generated from CSA with DG2. Apart from that, a novel Iterative Sizing Algorithm (ISA) was also developed to present an iterative approach towards sizing process when there were numerous sets of PV module and inverter need to be considered. At this stage, a database of PV module and a database of inverter were developed to form possible sizing solutions. It was discovered that the ISA based on DG2 had produced more feasible solutions compared to the ISA based on DG1 because DG2 was only limited to the available roof space whereas DG1 was limited to both the solar electricity requirement and the available roof space. Later, a new intelligent-based sizing algorithm for single objective functions, known as Evolutionary Programming-based Sizing Algorithm (EPSA) was developed using Meta-Evolutionary Programming (Meta-EP). In addition, a Non-Linear Step Size Scaling Factor (NLSS) was also presented to improve the performance of EPSA. It was found that the Meta-EP without NLSS had yielded better optimal solutions compared to other EP models for every design case being presented despite producing worse optimal solutions compared to ISA. After the incorporation of NLSS in each EP model, the optimality of the solutions produced by each EP model had been improved. Nevertheless, only Meta-EP with NLSS had successfully produced similar optimal solution suggested in ISA for each design case. Next, using Meta-EP with NLSS, new intelligent-based sizing algorithms based on two objective functions had been presented, namely the Weighted Sum Method-based Sizing Algorithm (WSMSA) and the Multi-Objective Evolutionary Programming-based Sizing (MOEPSA). Based on six bi-objective design cases being investigated, MOEPSA had outperformed WSMSA in producing more Pareto optimal solutions and better approximation of the Pareto front. Besides that, a new intelligent technique was also presented to predict the energy output from GCPV systems. At this stage, a classical Multi-Layer Feedforward Neural Network (MLFNN) was developed using systematic training, testing and validation procedures. The results showed that the MLFNN performed better than Linear Regression (LR) in predicting the output of the systems. Finally, a novel Hybrid Multi-Layer Feedforward Neural Network (HMLFNN) using Meta-EP with NLSS was developed to improve the classical MLFNN. The results showed that the HMLFNN model had shown better prediction performance when compared to the classical MLFNN and HMLFNN using selected optimization methods.