Editorial

Tai Cheng Yang

Department of Engineering and Design,
University of Sussex,
Brighton BN1 9QT, UK
E-mail: t.c.yang@sussex.ac.uk

Biographical notes: Tai Cheng Yang is a Reader at the Department of Engineering and Design University of Sussex, Brighton BN1 9QT, UK. He received his MSc and PhD, both in Control Engineering, in 1981 from Shanghai Tong-Ji University, China, and in 1987 from the University of Manchester Institute of Science and Technology, UK, respectively. He has more than 120 publications and among them 47 are journal papers. His current research interests include networked control systems, wind power and power system control, and control applications. For further information, including the abstracts of his papers on wind power generations, please see http://www.sussex.ac.uk/Users/taiyang/.

Renewable power generation, in particular wind power generation, is to benefit society and has attracted a great deal of research interests. Wind power generation (WPG) is a multidiscipline subject and there are currently a few special issues on WPG in power engineering journals, for example *IEEE Transactions on Power Systems* (August, 2007). However, there is no such special issue appearing in system/control/signal journals. This special issue of *International Journal of Modelling, Identification and Control (IJMIC)* presents five papers on WPG by system/control/signal professionals. Currently participation in the research on WPG by control professionals is low. Only very small proportion of journal/conference papers published by the IFAC, UKACC and IEEE control system society are on this subject, but this is expected to change in the coming years. Wind is a major resource of renewable energy and there are many challenges facing control professionals for effective use of this important natural resource for green power generation.

The first paper in this special issue is on 'Wind characteristics and power density analysis for Vadravadra site in Fiji Islands'. Due to the rising cost of conventional fuel, increased demand for the electrical energy and the huge amounts of pollution that are occurring in the world today has lead human kind to look for alternative forms of power generation. One of the alternative power sources is wind energy. However, wind is intermittent and to find the economic viability of a site for wind turbine installation, wind resource assessment (WRA) must be carried out to help wind planners to make right decisions. In WRA the wind characteristics for a site must be determined so that the wind speed frequency, duration and diurnal variation in wind speed is known to wind energy planners. Wind rose and turbulence intensity for the site must also be determined. This paper presents wind characteristics and wind power density analysis for Vadravadra site in Gau Island in Fiji.

The second paper in this special issue is on 'Wind turbine power coefficient real-time identification'. A scheme for real-time identification of a wind turbine power coefficient curve is presented. Knowledge of this curve is important to maximise the generated electric power. The precise shape of this curve is difficult to predict as it depends on several factors: air density, humidity, temperature, wind speed and tip speed. Once the power coefficient curve is found, it is possible to propose reference power points appropriate for the turbine mode of operation that are fed to a controller of the electric generator. Simulation results show good performance of this identification scheme.

The third paper in this special issue is on 'An intelligent neuro-fuzzy logic controller for induction generator based wind generation to improve power system stability'. Power systems are non-linear and they are often subjected to random disturbances. This paper deals with the application of the intelligent neuro-fuzzy technique to the design of the robust power system stabiliser for power system oscillation damping enhancement in a wind turbine based power system network. The stabilising signal is computed in real time using suitable fuzzy membership functions depending upon the state of the generator on the speed-acceleration phase plane. These input signals are first characterised by a set of linguistic variables using fuzzy set notations. The fuzzy relation matrix, which gives the relationship between stabiliser inputs and stabiliser output, allows a set of fuzzy logic operations that are performed on stabiliser inputs to obtain the desired stabiliser output. The performance of the proposed controller is analysed in a single induction machine-infinite bus power system data subjected to various dynamic and transient disturbances. The proposed intelligent neuro-fuzzy control scheme exhibits a superior damping performance in comparison to the conventional controllers. Its simple architecture reduces the computational burden, thereby making it attractive for real-time implementation.

The fourth paper in this special issue is on 'ANN based reactive power control of isolated wind-diesel-micro-hydro hybrid power systems'. This paper develops a mathematical modelling of isolated wind-diesel-micro-hydro hybrid power system and presents an artificial neural network (ANN) based approach to tune the parameters of static var compensator (SVC) to meet the reactive power requirement of hybrid system. In the hybrid system considered, synchronous generator is connected on diesel-generator (DG) and induction generators connected on wind and micro-hydro system. The system also has a SVC to provide the required reactive power in addition to the reactive power generated by the synchronous generator. The multi-layer feed-forward ANN with the error back-propagation training is employed to tune the gain of SVC. The dynamic responses presented show that SVC tuned by the ANN can provide optimum dynamic performance of the hybrid power system over a wide range of typical load models.

The last paper, the fifth paper in this special issue is on 'Modelling wind turbine mechanical power by friction effects'. The mechanical power of a wind turbine is modelled from a friction phenomenon perspective. Two models for the available power are proposed based on a relative speed between the wind speed and turbine blades. The main advantage of these new models is in the possibility of using real-time standard identification techniques for recovering their parameter values. Models are compared with a heuristic reference model showing good performance.