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SMART GRID

TECHNOLOGY AND APPLICATIONS

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Preface

Electric power systems throughout the world are facing radical change stimulated by the pressing need to decarbonise electricity supply, to replace ageing assets and to make effective use of rapidly developing information and communication technologies (ICTs). These aims all converge in the Smart Grid. The Smart Grid uses advanced information and communication to control this new energy system reliably and efficiently. Some ICT infrastructure already exists for transmission voltages but at present there is very little real-time communication either to or from the customer or in distribution circuits.

The Smart Grid vision is to give much greater visibility to lower voltage networks and to enable the participation of customers in the operation of the power system, particularly through Smart Meters and Smart Homes. The Smart Grid will support improved energy efficiency and allow a much greater utilisation of renewables. Smart Grid research and development is currently well funded in the USA, the UK, China, Japan and the EU. It is an important research topic in all parts of the world and the source of considerable commercial interest.

The aim of the book is to provide a basic discussion of the Smart Grid concept and then, in some detail, to describe the technologies that are required for its realisation. Although the Smart Grid concept is not yet fully defined, the book will be valuable in describing the key enabling technologies and thus permitting the reader to engage with the immediate development of the power system and take part in the debate over the future of the Smart Grid.

This book is the outcome of the authors' experience in teaching to undergraduate and MSc students in China, Japan, Sri Lanka, the UK and the USA and in carrying out research. The content of the book is grouped into three main technologies:

1. Part I Information and communication systems (Chapters 2–4)
2. Part II Sensing, measurement, control and automation (Chapters 5–8)
3. Part III Power electronics and energy storage (Chapters 9–12).

These three groups of technologies are presented in three Parts in this book and are relatively independent of each other. For a course module on an MEng or MSc in power systems or energy Chapters 2-4, 5-7 and 9-11 are likely to be most relevant, whereas for a more general module on the Smart Grid, Chapters 2–5 and Chapters 9 and 12 are likely to be most appropriate.

The technical content of the book includes specialised topics that will appeal to engineers from various disciplines looking to enhance their knowledge of technologies that are making an increasing contribution to the realisation of the Smart Grid.