

Preface

Wireless Power Transfer (WPT) has recently evolved as a very active research subject in the field of ad hoc communication networks, as well as a topic of rapid technological progress and emerging practical development and application activities. However, a solid foundational, systemic and applied background seems still necessary for wireless power transfer to achieve its full potential. The provisioning of relevant abstract models, algorithmic design and analysis methods, networking principles, circuit and system design and application methodologies is a challenging task.

Several such models, algorithms, circuits, systems and applications for WPT have already appeared, in relevant journals, conferences and workshops. This book aims to reinforce the emergence of a critical mass of algorithmic and applied foundations by bringing together, for the first time in a systematic way, high quality research contributions (in the form of invited book chapters) by leading experts worldwide, relevant to important algorithmic, systematic and technological WPT applications in ad hoc communication networks.

The book is structured into six themes covering respective common aspects, issues and methodologies. This division is rather indicative; because of the inherent relations of different topics, layers and problems, many chapters could be associated to more than one theme, and the themes themselves could have been chosen in a different manner. Still, we hope that the particular structure will be methodologically useful for the reader.

We now briefly describe each theme. The first one discusses characteristic key circuits and technologies for wireless power transfer in communication networks and briefly presents several regulations. The second theme presents several applications for achieving efficient communication in wirelessly powered networks and identifies relevant performance trade-offs. The next theme concerns basic efficient solutions for mobility management in WPT networks, both distributed and centralized. Mobile nodes and chargers, effective traversal strategies, cost minimization of mobile elements and use of cutting edge technologies like UAVs are some of the proposed approaches. The fourth theme covers the concept of energy flow, a major challenge in wirelessly powered networks. Different aspects of energy flow

are addressed, such as collaborative mobile charging, hierarchy assignment, use of resonant repeaters and energy balance in populations of mobile peers. Different networking operations that can be combined with WPT are addressed in the fifth theme, such as routing, data gathering and solar energy harvesting. The book concludes with a recent combination of research between wireless power transfer and electromagnetic radiation awareness. In particular, two algorithmic approaches, which apply radiation control methods for ensuring human safety without sacrificing effectiveness, are presented.

The intended audience of this book includes researchers and advanced graduate students working on ad hoc communication networks and wireless power transfer, as well as practitioners in relevant application domains interested to obtain a broader foundational and technological perspective and insight. The book can also serve as a text for advanced university courses and research seminars.

We hope that this book will be helpful to its readers and contribute to a solid foundation and deeper understanding of the fascinating and rapidly evolving research area of wireless power transfer.

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