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Wireless Charging Technology and the Future of Electric Transportation

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Nikola Tesla’s Wardenclyffe Tower experiment in Long Island in the early 1900s, the transmittance of electricity from a source to an electric device without a wire or cord has been pursued for more than a century. While current automotive industry is focused on developing static wireless charging of electric vehicles for plug-in hybrid or electric vehicles with the delivering capacity below 7 kW ranges, a few prototype technologies are demonstrated with dynamic wireless charging capabilities with more than several 10 kW ranges. One example described in this book is the historic public launch of a people mover vehicle in Seoul Grand Park, Korea, with dynamic wireless charging capability, which was led by Dr. In-Sooh, the principal editor of this book. Around the world, the major automakers are developing their strategies for conductive and wireless charging technologies, with concerted efforts to establish technical standards on wireless electric vehicle charging, mainly focused on the safety considerations and interoperability—"Provided by publisher.

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Foreword

In January 2011, I edited the SAE Publication, Green Technologies and the Mobility Industry. It addressed the new “green paradigm,” which considers the environment as a vital aspect of doing business. The environment and climate change, the price of oil and its security, and economic concerns are all challenges facing regional and global economies. Advances in electric vehicle development are a great example of how the mobility industry is responding with technological solutions that are less polluting, more sustainable, and efficient in the long run. Dr. In-Soo Suh and his colleagues in this publication, Wireless Charging Technology and the Future of Electric Transportation, continue this theme and advance the case for electrification as a mobility solution.

Although no industry can ever turn its back to cost efficiencies, the equation now also includes the monetary and nonmonetary price of environmental damage, the lasting impact of the carbon footprint, and the value of being socially responsible. Around the world, governments are increasingly regulating and restricting greenhouse gas (GHG) emissions, and incentivizing the creation and use of nonpolluting technologies.

Over the next decade or so, industry forecasts show increased growth in production of electric vehicles in Asia, despite the low penetration rates thus far. Most analysts are conservative showing penetration rates under 5%, but some of the industry predictions actually foresee up to 15% market share by 2025. More vehicle development programs will continue to take place.

Around the world, the major automakers are developing their strategies for conductive and wireless charging technologies, with concerted efforts to establish technical standards on wireless electric vehicle charging, mainly focused on the safety considerations and interoperability. The operating frequency allocation and electromagnetic field exposure to the human body, in addition to existing electrical safety requirements, have been significant issues for technical standard communities.

While the current automotive industry is focused on developing static wireless charging for plug-in hybrid or electric vehicles, delivering capacity below the 7 kW range, a few prototype technologies have demonstrated dynamic wireless charging capabilities with ranges over 10 kW. One example described in this book is the public launch of a people mover vehicle in Seoul Grand Park, Korea, which was led by Dr. In-Soo Suh.

Wireless Charging Technology and the Future of Electric Transportation covers the current status of wireless power transfer (WPT) technology and its potential applications to future road and rail transportation systems. It is a reference and provides an in-depth analysis of the most important areas of interest in this new field, including the following topics:

- Working principles of wireless power transfer technology
- Current technology and its projected future impact on electric vehicles
• Comparison between conductive and wireless charging of electric vehicles
• Introduction to dynamic wireless charging systems
• Technological challenges and international technical standards activities
• Applications in consumer electronics, rail, aviation, marine, and off-road transportation
• Long-distance electrical energy transfer

By providing status on recent research and development, it is an invaluable aid to readers, young engineers, researchers, and others seeking advanced knowledge on these subjects.

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Special thanks go out to Dr. Andrew Brown for kind encouragement and thorough feedback through the review process. During the editing process, my PhD student, J. Kim, provided great assistance, and Ms. Monica Nogueira of SAE International provided continuous advice and helpful revisions throughout the drafting process.

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