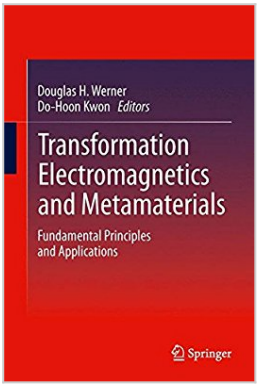

Transformation Electromagnetics and Metamaterials: Fundamental Principles and Applications

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Transformation electromagnetics is a systematic design technique for optical and electromagnetic devices that enables novel wave-material interaction properties. The associated metamaterials technology for designing and realizing optical and electromagnetic devices can control the behavior of light and electromagnetic waves in ways that have not been conventionally possible. The technique is credited with numerous novel device designs, most notably the invisibility cloaks, perfect lenses and a host of other remarkable devices.

Transformation Electromagnetics and Metamaterials: Fundamental Principles and Applications presents a comprehensive treatment of the rapidly growing area of transformation electromagnetics and related metamaterial technology with contributions on the subject provided by a collection of leading experts from around the world. On the theoretical side, the following questions will be addressed: “Where does transformation electromagnetics come from?,” “What are the general material properties for different classes of coordinate transformations?,” “What are the limitations and challenges of device realizations?,” and “What theoretical tools are available to make the coordinate transformation-based designs more amenable to fabrication using currently available techniques?” The comprehensive theoretical treatment will be complemented by device designs and/or realizations in various frequency regimes and applications including acoustic, radio frequency, terahertz, infrared, and the visible spectrum. The applications encompass invisibility cloaks, gradient-index lenses in the microwave and optical regimes, negative-index superlenses for sub-wavelength resolution focusing, flat lenses that produce highly collimated beams from an embedded antenna or optical source, beam concentrators, polarization rotators and splitters, perfect electromagnetic absorbers, and many others.

This book will serve as the authoritative reference for students and researchers alike to the fast-evolving and exciting research area of transformation electromagnetics/optics, its application to the design of revolutionary new

devices, and their associated metamaterial realizations.

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Editorial Review

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Douglas H. Werner received the B.S., M.S., and Ph.D. degrees in electrical engineering and the M.A. degree in mathematics from The Pennsylvania State University (Penn State), University Park, in 1983, 1985, 1989, and 1986, respectively. He holds the John L. and Genevieve H. McCain Chair Professorship in The Pennsylvania State University Department of Electrical Engineering. He is the director of the Penn State Computational Electromagnetics and Antennas Research Laboratory as well as a member of the Communications and Space Sciences Lab (CSSL). He is also a faculty member of the Materials Research Institute (MRI) at Penn State. Prof. Werner has extensive experience in computational electromagnetics with an emphasis on the modeling/design of antennas (including conformal antennas and nanoantennas) and phased arrays (including ultra-wideband arrays) as well as frequency selective surfaces, metamaterials, and transformation electromagnetics/optics devices for a variety of RF, THz, IR and visible wavelength applications. He is a recognized authority on nature-inspired global optimization techniques (e.g. genetic algorithms, particle swarm, clonal selection, etc.) and their application to solving complex electromagnetic design problems.

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