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	Autore	Park Il Han
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	Nota di contenuto	1. Introduction -- 1.1 Optimal Design Process -- 1.2 Design Steps of Electromagnetic System -- 1.3 Design Variables -- 1.4 Equations and Characteristics of Electromagnetic Systems -- 1.5 Design Sensitivity Analysis -- 2. Variational Formulation of Electromagnetic Systems -- 2.1 Variational Formulation of Electrostatic System -- 2.2 Variational Formulation of Magnetostatic System -- 2.3 Variational Formulation of Eddy Current System -- 2.4 Variational Formulation of DC Conductor System -- 3. Continuum Shape Design Sensitivity of Electrostatic System -- 3.1 Material Derivative and Formula -- 3.2 Shape Sensitivity of Outer Boundary -- 3.3 Shape Sensitivity of Outer Boundary for System Energy -- 3.4 Shape Sensitivity of Interface -- 3.5 Shape Sensitivity of Interface for System Energy -- 4. Continuum Shape Design Sensitivity of Magnetostatic System -- 4.1 Interface Shape Sensitivity -- 4.2 Interface Shape Sensitivity for System Energy -- 5. Continuum Shape Design Sensitivity of Eddy Current System -- 5.1 Interface Shape Sensitivity -- 5.2 Interface Shape Sensitivity for System Power -- 6. Continuum Shape Design Sensitivity of DC Conductor System -- 6.1 Shape Sensitivity of Outer Boundary -- 6.2 Shape Sensitivity of Outer Boundary for Joule loss power -- 7. Level Set

Method and Continuum Sensitivity -- 7.1 Level Set Method -- 7.2 Coupling of Continuum Sensitivity and Level Set Method -- 7.3 Numerical Considerations -- 8. Hole and Dot Sensitivity for Topology Optimization -- 8.1 Hole Sensitivity -- 8.2 Dot Sensitivity -- Appendix A. More Examples of Electrostatic System -- Appendix B. More Examples of Magnetostatic System -- Appendix C. More Examples of Eddy Current System -- Appendix D. More Examples of DC Conductor System.

| Sommario/riassunto | This book presents a comprehensive introduction to design sensitivity analysis theory as applied to electromagnetic systems. It treats the subject in a unified manner, providing numerical methods and design examples. The specific focus is on continuum design sensitivity analysis, which offers significant advantages over discrete design sensitivity methods. Continuum design sensitivity formulas are derived from the material derivative in continuum mechanics and the variational form of the governing equation. Continuum sensitivity analysis is applied to Maxwell equations of electrostatic, magnetostatic and eddy-current systems, and then the sensitivity formulas for each system are derived in a closed form; an integration along the design interface. The book also introduces the recent breakthrough of the topology optimization method, which is accomplished by coupling the level set method and continuum design sensitivity. This topology optimization method enhances the possibility of the global minimum with minimised computational time, and in addition the evolving shapes during the iterative design process are easily captured in the level set equation. Moreover, since the optimization algorithm is transformed into a well-known transient analysis algorithm for differential equations, its numerical implementation becomes very simple and convenient. Despite the complex derivation processes and mathematical expressions, the obtained sensitivity formulas are very straightforward for numerical implementation. This book provides detailed explanation of the background theory and the derivation process, which will help readers understand the design method and will set the foundation for advanced research in the future. |