APPROPRIATE FINITE ELEMENT METHOD FOR PARTICULAR INVERSE PROBLEMS- SPECIAL MESH GENERATOR

A THESIS PRESENTED

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ABSTRACT

Appropriate Finite Element Method for Particular Inverse Problems - Special Mesh Generator

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Research effort has increasingly focused on extending the now well-established finite element analysis to the inverse problems of design optimization. For the purpose of optimization, an electromagnetic design is fully described by variables whose values have to be determined in order to obtain a design that satisfies specified performance criteria. An optimal design process is solving a sequence of analysis problems. An inverse problem can be either a synthesis problem or an identification problem. The latter always has a solution, even multiple solutions, which may be difficult to find numerically, whilst a solution may not exist for synthesis problems when the performance desired is impracticable and indeed may even be multiple in nature.

This thesis concentrates on aspects of inverse problems, particularly shape synthesis optimization of electromagnetic devices in relation to a suitable mesh generator.

Computation of derivatives is involved in both optimization and force computation. But the computation of derivatives with the Finite Element Method is difficult.

The main contribution of this thesis is a special mesh generator to compute derivatives accurately and easily addressing the problem of lack of C^1continuity of the object function.

Applications in optimization and force computation with this mesh generator are presented.

Force computation by the virtual work method is easy but not used because of the problem of derivative accuracy. So far more difficult methods are used. When applied to force computation this mesh generator makes computations by the virtual work principal accurate as shown in this thesis.

The summary of the main part of this work is reported in a journal paper (http://www.elsevier.com/wps/find/journalabstracting.cws_home/505656/abstracting#abstracting) and the paper is reproduced in the Appendix.