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★ **On numerical methods for shape design problems.**

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This paper is a summary of the author's thesis dealing with the mathematical setting and the numerical implementations of optimal shape design (OSD), which appears in applied structural analysis problems. From the mathematical point of view, OSD is a branch of the calculus of variations and especially of optimal control where study is devoted to the problem of finding the optimal shape for an object. OSD can be divided into three classes: domain optimization (or variable boundary optimization), optimal sizing and topology optimization. This paper is mainly concerned with the first class of problems. A general mathematical formulation for the shape optimization problems is presented, and its numerical approximations are discussed. Model examples of OSD are outlined.

The different types of adaptive finite-element analysis are presented: r -method (relocation of the grid nodes), p -method (variation of the order of the polynomial approximation), and h -method (modification of the element size). One crucial step in the optimization procedure is often the sensitivity analysis. The results obtained concerning the accuracy, the CPU-time and the ease of use of different sensitivity analysis methods are summarized. Sensitivity analysis by symbolic computation is also presented as an additional variant. Application problems are presented. The present state of the art in adaptive finite-element analysis is presented and some systems for structure design are reviewed.

Reviewed by [P. Rochus](#) (Liège)

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