A 2D Elasticity Topological Optimization Design and *Element by Element* Technique

J. Tomás Pereira[1], A. A. Novotny[2] & E. A. Fancello[2]

[1]NUPES/DAMEC - Núcleo de Pesquisa em Eng. Simultânea, Depto. de Mecânica.
Centro Federal de Educação Tecnológica do Paraná - BRASIL

[2]GRANTE - Grupo de Análise de Tensões, Depto. de Eng. Mecânica,
Universidade Federal de Santa Catarina - BRASIL

June 30, 1997

Abstract

The automatic improvement of devices topology design, to transfer mechanical forces from a given point to another one, making use of mathematical programming (Bertsekas, 1995) is nowdays an important issue in computational mechanics. By reasons of cost in the great practical situations minimum mass spare parts are required. In this work, a possible way to obtain the optimum topology of 2D elasticity structure type, under geometrical and mechanical constraints, is presented. The methodology adopted was firstly presented by Souza de Cursi (1994). In this approach the topology is characterized by an unknown thickness map (ρ) which is introduced in the solids equilibrium equations in order to obtain a problem where (ρ) is explicitly involved. If one consider that optimal topology is done in accordance to minimum mass criterion, subject to von Mises plastic collapse constraint, then for the situation considered the determination of optimum thickness (ρ^*) is equivalent to the determination of optimal topology. In the case that ($\rho > 0$) one have a fully stressed design condition, otherwise, *i.e.* if ($\rho = 0$) one have the holes. This result leads to a non-linear equation where (ρ^*) is now explicitly involved. A simple method to obtain approximately the optimal thickness map (ρ^*) consists in using a relaxation procedure (Souza de Cursi, 1995). In this work, a more sophisticated method was employed that consists of solving the same problem through Newton-Raphson method using the *Element by Element* technique to solve the linear system of equation.

References

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