Topology optimization with local stress constraint based on level set evolution via reaction-diffusion

Hélio Emmendoerfer Jr., Eduardo Alberto Fancello

PII: S0045-7825(16)30054-8
DOI: http://dx.doi.org/10.1016/j.cma.2016.02.024
Reference: CMA 10856

To appear in: *Comput. Methods Appl. Mech. Engrg.*

Received date: 1 July 2015
Revised date: 16 February 2016
Accepted date: 17 February 2016

Topology optimization with local stress constraint based on level set evolution via reaction-diffusion

Hélio Emmendoerfer Jr., Eduardo Alberto Fancello*

Department of Mechanical Engineering, Federal University of Santa Catarina, Campus Universitário - Trindade, 88040-900, Florianópolis, SC, Brazil

Abstract

This work focuses the structural topology optimization problem of mass minimization subject to local stress constraints. To this aim, two related issues are addressed. The first one is the successful strategy used to define local stress constraints by means of an Augmented Lagrangian approach. The second, and main contribution of the present paper, is the use of a reaction-diffusion equation to guide, via evolution of a level set, the design optimization sequence. The advantages of this strategy are twofold: firstly, it allows the creation of new holes during the optimization process, a significant feature for a true topological optimization method. Secondly, reinitialization steps usually found in classical Hamilton-Jacobi based evolution are eliminated with a significant improvement in convergence ease. A set of benchmark examples in two dimensions are presented. Numerical results show the efficiency of the algorithm to create new holes, identify stress concentrations and to provide stable optimization sequences converging to local

*Corresponding author

Email addresses: helio.e.j@posgrad.ufsc.br (Hélio Emmendoerfer Jr.), eduardo.fancello@ufsc.br (Eduardo Alberto Fancello)