Level set topology optimization for design-dependent pressure load problems

Abstract
This work presents a level set framework to solve the compliance topology optimization problem considering design-dependent pressure loads. One of the major technical difficulties related to this class of problem is the adequate association between the moving boundary and the pressure acting on it. This difficulty is easily overcome by the level set method that allows for a clear tracking of the boundary along the optimization process. In the present approach, a reaction-diffusion equation substitutes the classical Hamilton-Jacobi equation to control the level set evolution. This choice has the advantages of allowing the nucleation of holes inside the domain and the elimination of the undesirable reinitialization steps. Moreover, the proposed algorithm allows merging pressurized (wet) boundaries with traction-free boundaries during level set movements. This last property, allied to the simplicity of the level set representation and successful combination with the reaction-diffusion based evolution applied to a design-dependent pressure load problem, represents the main contribution of this paper. Numerical examples provide successful results, many of which comparable with others found in the literature and solved with different techniques. (AU)