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# TOPOLOGICAL OPTIMIZATION MODELLING CONSIDERING UNCERTAINTIES

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A structural design should ensure suitable working conditions requiring safety and economic criteria. In most structural designs, the desired solution is not easy available, as these conditions depend on the bodies' dimensions, materials' strength and structural system configuration. Topological optimization is a scientific domain that aims to achieve the optimal structural geometry, i.e. the shape that leads to the minimum requirement of material respecting constraints related to stress state at any structural point. The present study applies an evolutionary approach to determine the optimal geometry of 2D structures by coupling the Boundary Element Method (BEM) and the Level Set Method (LSM).

The proposed algorithm consists of mechanical model, topological optimization and structure reconstruction. The mechanical model is composed by singular and hyper-singular BEM algebraic equations. The topological optimization is performed using LSM. The internal and external geometries are determined by the Level Set function evaluated at its zero level. The reconstruction process concerns the remeshing procedure. As the boundary moves at each iteration, the body's geometry change and a new mesh has to be defined. During the optimization process, the proposed algorithm introduces automatically internal cavities, according to the intensity of Von Mises stress at the cavity centre.

In spite of the optimal structural geometry be achieved, any information is provided concerning the inherent randomness that exist on all mechanical problem, such as material properties and load intensity, for instance. In this regard, this study aims to evaluate the structural reliability of the optimized structure. The volume target required in the optimization procedure is replaced by the reliability index, which makes the analysis consistent in the context of safety. The results obtained demonstrate the efficiency of the proposed model.