TOPOLOGY OPTIMIZATION WITH LOCAL STRESS CONSTRAINTS: A COMPARATIVE ANALYSIS USING QUADRILATERAL AND POLYGONAL MESHES

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Abstract. *This work addresses topology optimization for minimum mass under local stress constraints and compares different discretization alternatives, namely standard quads with polygons obtained from Voronoi tessellations. A finite number of stress constraints are conveniently distributed over the domain and imposed through an augmented Lagrangian approach. Within a level-set context, the stress constraint function is continuously activated/deactivated during the movement of the boundaries. The level-set evolution makes use of a reaction-diffusion equation and sensitivity analysis to update the structural topology. From the aforementioned description, the numerical solution is performed using meshes with quadrilateral elements, widely used in topology optimization problems, and with polygonal elements, which is uncommon in the literature for such problems. The benefits and drawbacks of employing each meshing strategy are discussed. For comparison purposes, a set of classical examples are used to show the capability of the algorithm to detect stress concentrations on both mesh discretizations.*

Keywords: *Topology optimization, Level sets, Local stress constraints, Augmented Lagrangian, Polygonal finite elements*