S. Czarnecki, T. Lewiński, *The isotropic material design of in-plane loaded elastic-plastic plates,* Materials, 2021, 14(23), 7430;
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Abstract
This paper puts forward a new version of the Isotropic Material Design method for the optimum design of structures made of an elasto-plastic material within the Hencky-Nadai-Ilyushin theory. This method provides the optimal layouts of the moduli of isotropy to make the overall compliance minimal. Thus, the bulk and shear moduli are the only design variables, both assumed as non-negative fields. The trace of the Hooke tensor represents the unit cost of the design. The yield condition is assumed to be independent of the design variables, to make the design process as simple as possible. By eliminating the design variables, the optimum design problem is reduced to the pair of the two mutually dual Linear Constrained Problems (LCP). The solution to the LCP stress-based problem directly determines the layout of the optimal moduli. A numerical method has been developed to construct approximate solutions, which paves the way for constructing the final layouts of the elastic moduli. Selected illustrative solutions are reported, corresponding to various data concerning the yield limit and the cost of the design. The yield condition introduced in this paper results in bounding the values of the optimal moduli in the places of possible stress concentration, such as reentrant corners.