**MODIFIED GRADIENT-FREE PROPORTIONAL TOPOLOGY OPTIMIZATION FOR HEAT CONDUCTION PROBLEM**

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**Abstract.** In this study, the optimization of heat conduction is addressed by means of the gradient-free proportional topology optimization (PTO) algorithm. A pseudo density field is introduced, and the thermal conductivity is determined by considering the solid isotropic material with penalization (SIMP) method. The numerical solutions of the heat conduction equation are obtained by employing the conventional finite element method. With the original PTO algorithm, the density of each element is considered constant, and the performance can be degraded by several numerical instabilities, e.g., one-node connected hinges and wriggle boundaries. In this study, a modified PTO algorithm is proposed to allow the interpolation of the density with nodal discrete values, and thus, remove drawbacks of the original PTO algorithm mentioned above. The advantageous features of the modified PTO algorithm are highlighted through several numerical examples.

**Keywords:** gradient-free proportional topology optimization; heat conduction; finite element methods; solid isotropic material with penalization (SIMP);