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Topology Optimization of the Interior Structures of Beams under Various Load and Support Conditions with Solid Isotropic Material with Penalization Method

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Abstract : Topology optimization is an approach that optimizes material distribution within a given design space for a certain load and boundary conditions by providing performance goals. It uses various restrictions such as boundary conditions, set of loads, and constraints to maximize the performance of the system. It is different than size and shape optimization methods, but it reserves some features of both methods. In this study, interior structures of the parts were optimized by using SIMP (Solid Isotropic Material with Penalization) method. The volume of the part was preassigned parameter and minimum deflection was the objective function. The basic idea behind the theory was considered, and different methods were discussed. Rhinoceros 3D design tool was used with Grasshopper and TopOpt plugins to create and optimize parts. A Grasshopper algorithm was designed and tested for different beams, set of arbitrary located forces and support types such as pinned, fixed, etc. Finally, 2.5D shapes were obtained and verified by observing the changes in density function.

Keywords : Grasshopper, lattice structure, microstructures, Rhinoceros, solid isotropic material with penalization method, TopOpt, topology optimization
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