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# A REDUCED MULTISCALE MODEL FOR NONLINEAR STRUCTURAL TOPOLOGY OPTIMIZATION

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This paper presents a reduced multiscale model for macroscopic structural design considering microscopic material nonlinear microstructures. This work introduces Reduced Order Model (ROM) to alleviate the heavy computational demand of nonlinear nested multiscale procedures, particularly in an optimization framework which requires multiple loops involving similar computations. The surrogate model constructed using Proper Orthogonal Decomposition (POD) and Diffuse Approximation reduces the computational effort for solving the microscopic boundary value problems. Multiscale analysis model ($FE^2$) is applied to link structure and microstructures in the two scales. Maximum stiffness design of the macroscopic structure is realized using a discrete level-set topology optimization model. It is shown by means of numerical tests that the reduced multiscale model provides reasonable designs as compared to those obtained by the unreduced model while with a significantly reduced computational effort.