PROPOSAL OF OPTIMALITY CRITERIA METHOD CONSIDERING THE NEWTON'S METHOD IN TOPOLOGY OPTIMIZATION PROBLEMS BASED ON THE DENSITY METHOD

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There are various update formulas in the optimization theory, i.e., the steepest descent method, the Newton's method, etc. The topology optimization based on the homogenization method or density method often use the optimality criteria (OC) method to update design variables [1]. Since the design variables are updated by the exponentiation, the OC method has a faster update rate than the steepest decent method [2]. However, in order to employ the OC method, it is important to set two arbitrary parameters: the weighting factor η, which is an exponent, and move-limit of design variable ς. Optimal results and calculation times depend on the parameters setting. In the proposed method, Newton's method is applied to the equation of the OC method, and the damping parameter become the function of density by its formulation. The proposed method can find the optimal structure without the move-limit ς quickly. In our study, the topology optimization is performed to minimize the strain energy for elastic body. The results of optimal structures when using the OC method and proposed method and the history of their performance function are shown in Figs. 1 to 3.

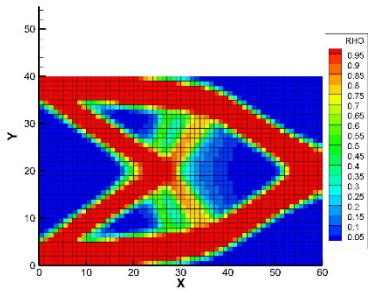

Fig. 1 Optimal structure obtained by the OC method.
($\eta = 0.75, \varsigma = 0.01$)

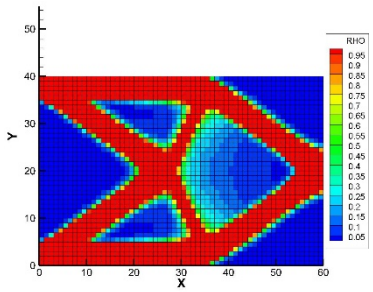

Fig 2 Optimal structure obtained by the proposed method.
(Without move-limit)

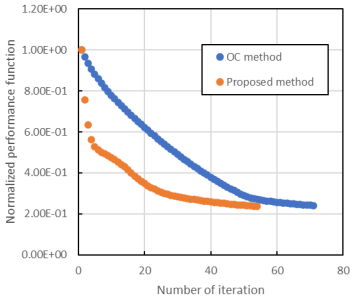

Fig. 3 History of normalized performance function.

References

[1] M. P. Bendsøe and O. Sigmund, Topology optimization: Theory, Methods and Applications, *Springer-Verlag Berlin Heidelberg GmbH*, 2003.

[2] K. Suzuki and N. Kikuchi, A homogenization method for shape and topology optimization, *Computer Method in Applied Mechanics and Engineering*, Vol. 93, 291-318, 1991.