Topology optimization for material and structural design

Junji Kato*[1]

[1] *Civil and Environmental Engineering, Nagoya University, Nagoya, Japan; kato.junji.i5@f.mail.nagoya-u.ac.jp*

Topology optimization is an effective tool for designing advanced structures and materials and it is being applied in a wide range of engineering fields. In this presentation, topology optimization with a single material and multiple materials considering material and/or kinematical nonlinearity is introduced. In addition to optimization problems targeting the topology of macroscopic structures, optimal design of microstructure based on the homogenization theory is presented.
The objective functions to be considered are maximizing stiffness, external work, energy absorption capacity and controlling vibration etc. These optimization problems are solved by the gradient-based approach and adjoint variable method is applied to obtain accurate sensitivity of design functions.
Finally, a series of numerical examples of some topology optimization problems [1, 2] are conducted to verify our optimization strategy and their structural performance.

References

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2. Kato, J.; Yachi, D.; Kyoya, T.; Terada, T., Micro-macro concurrent topology optimization for nonlinear solids with a decoupling multiscale analysis, *International Journal for Numerical Methods in Engineering*, **2018**, Vol. 113 (8), 1189–1213.