6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

TOPOLOGY DESIGN VIA PHYSICS-BASED SURROGATE OPTIMIZATION FOR COMPLEX FLUID PROBLEMS

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Keywords: *Topology Optimization, Physics-based Surrogate Optimization, Turbulence, Heat Transfer, Engineering Flow Field Design*

We propose a framework of innovative topology design that aims to find a satisfactory solution in a topology optimization problem dealing with complex physics such as turbulent flows. The basic idea of the proposed approach is that an original topology optimization problem, which is fundamentally difficult to solve due to its strong multimodality, high computational cost and so on, is replaced with a surrogate one. A satisfactory solution is led from the set of candidates generated via the surrogate topology optimization problem. In this study, the surrogate topology optimization problem is constructed on the basis of *physics-based surrogate optimization* [1], whose original concept is to reduce the computational cost of optimization problem, e.g. airfoil shape design. It should be emphasized that the proposed approach focuses on finding a solution in a complex topology optimization problem rather than the reduction of computational cost. The proposed approach sacrifices the mathematical optimality to find a satisfactory solution, and purposely utilize the designer's intuition for constructing an appropriate surrogate problem and selecting the promising solution from the set of candidates. From an engineering standpoint, we believe that these strategies are the essential key to further expand the applicability of topology optimization for complex and realistic design optimization problems. We demonstrate the efficacy of the proposed approach by applying to several topology optimization problems that deal with turbulent heat transfer and engineering flow field designs.

REFERENCES

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