Proceedings of the 1st international Symposium on AI and Fluid Mechanics
Paper No S14 P2

Interpretability vs. descriptive power of parametrizations in AI-assisted Aerodynamic Shape Optimization

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Abstract Often the choice of the geometry parametrization in shape optimization for fluid-dynamical tasks is characterized by the need to on the one hand find a low dimensional, efficient description of the considered configurations for fast computation of the optimization results, and, on the other hand be able to work with physically interpretable features[1]. Using a simple 2D airfoil design problem, we illustrate this dichotomy for the case of a reinforcement learning approach and suggest a procedure to maximize interpretability under a given highest dimensionality of the parameter space. The parametrization is a subfamily of the PARSEC-airfoil family [2]. The advantages in terms of physical interpretability and high descriptive power in comparison to NACA profiles is illustrated.

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Keywords: Geometry Parametrization, Aerodynamic Shape Optimization, Reinforcement Learning