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Editorial

Optimization with Surrogate Models: Flow and Heat Transfer Applications

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Optimization methods are now recognized to be vital in the design of fluid flow equipment and processes. Design optimization based on computational fluid dynamics (CFD) analysis has become a reliable tool for fluid flow and heat and mass transfer applications due to the rapid increase in computing power. However, to avoid expensive CFD simulations for entire design process, surrogate models are used to reduce the computational burden with a reliable representation of CFD data. The aim of the special issue was to bring together contributions from engineers, mathematicians, and computer scientists working on basic research and practical applications in engineering optimization. A substantial number of papers were submitted, and a total of 4 original research papers which covered the application of optimization techniques to flow and heat transfer problems are published in the special issue.

Q. Yao et al. studied an air conditioning system using Reynolds averaged Navier-Stokes equations and performed optimization to determine the optimal air supply directions that would provide the most stable velocity field and temperature distribution. However, the influence on cooling rate and energy utilization coefficient was found to be negligible. X. Fang et al. conducted parameter optimization of induction heating of large-diameter pipes based on the magnetic-thermal coupling in the heating process by sequential coupling method. The influence of heating process parameters like current frequency, current density, and air gap on the temperature of inner and outer walls of the pipe was obtained using orthogonal arrays. The optimal parameters were obtained using neural network and genetic algorithm. J. Liu et al. conducted three-dimensional numerical simulations based on Eulerian-Lagrangian approach to investigate particles distribution in a separator. The discrete phase method (DPM) was applied to monitor the motion of particles. Based on the numerical analysis, the structure of separator was optimized using Taguchi method, and the optimal structure was evaluated based on signal-to-noise ratio (SNR).

Finally, the review paper by M. H. Siddique et al. presented the application of surrogate-based optimization in the context of turbomachines. The authors provided a brief overview of the technique along with its historical applications and trends in recent use. A substantial number of research articles were cited that involve the use of surrogate models for optimization of centrifugal pumps.

Conflicts of Interest

The editors declare that they have no conflicts of interest regarding the publication of this special issue.

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