Enhanced Fin Tube Heat Exchanger Design Through Topology Optimization

Shi Zeng[1]

[1]National University of Singapore, Singapore

Abstract

Fin tube heat exchangers are widely used in air conditioning systems. Various fin structures have been proposed and studied in literature to enhance their heat transfer performance. However, enhancement in heat transfer is often accompanied by pressure drop penalty. This study utilized a numerical method, topology optimization, to design novel fin structures for enhancing heat transfer performance while maintaining pressure drop as low as possible. In the optimization process, volume constraints were applied to add fins into the original fin tube with the assumption that increased heat transfer areas would lead to better heat transfer performance. Minimizing pressure drop was set as the objective so that the fins were added in a manner that could achieve better overall performance. Finally, the performance of the optimized fin structures were validated through full 3D conjugate heat transfer simulation.

Figures used in the abstract

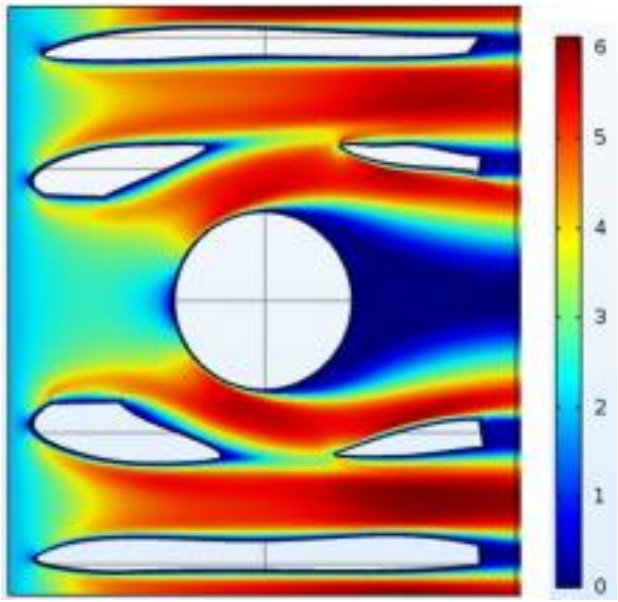

Figure 1: The velocity contour of the optimized structure, showing 6 pieces of fins with irregular shapes have been added surrounding the original circular tube