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Design and Comparative Analysis of Counter Flow Heat Exchanger using Conical Coil

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Abstract: *Conical coil heat exchangers (CCHEs) have emerged as an innovative alternative to traditional helical configurations due to their unique geometry, which promotes enhanced secondary flow and improved thermal performance. This study presents a detailed computational fluid dynamics (CFD) analysis of a conical shell-and-coil heat exchanger using ANSYS Fluent, focusing on realistic operational conditions, advanced turbulence modeling, and multi-material domain integration. Unlike previous works that primarily addressed simplified geometries and single-phase flow, this research incorporates variable inlet mass flow rates, complex shell-side interactions, and the thermal effects of construction materials such as copper and aluminum. The simulations evaluate steady-state behavior under turbulent flow, using the realizable k-ε turbulence model to capture swirl and recirculation phenomena prevalent in conical geometries. Results reveal significant improvements in heat transfer efficiency and flow distribution due to the conical configuration, with further insights into pressure drop, thermal gradients, and material influence. This study fills key gaps in existing literature by providing a high-fidelity numerical framework for optimizing conical coil heat exchangers in industrial applications.*

Keywords: Heat exchangers, conical coil , liquid flow , copper

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