Development of a surrogate model for open rack vaporizer system based on the 2D first principle equations and computational fluid dynamics data

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Open rack vaporizer (ORV) is a seawater heat exchanger that vaporizes LNG into natural gas using seawater as a heat medium and is widely used around the world. The fluid and heat flow analysis of ORV is generally performed through the computational fluid dynamics (CFD), but it has a heavy computational burden for a single simulation, so control or optimization applications are limited. In order to analyze the structural complexity and turbulence of the ORV system quickly, approximated equations or surrogate model for the ORV CFD model is proposed using the 2D 1st principle equations. In the 1st principle equations, important parameters were found through sensitivity analysis, and parameter estimation was performed based on the analysis results of CFD to complete the surrogate model. The results analyzed through the surrogate model are expected to help understand turbulence along with various structural factors, and furthermore, it will enable preliminary performance evaluation for ORVs of various structures.