

Performance Optimization of Steam Jet Ejector using CFD

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Abstract

Jet ejectors are popular in the chemical process industries because of their simplicity and high reliability. They are widely used to generate vacuums with capacity ranges from very small to enormous. Due to their simplicity, constant-pressure jet ejectors that are properly designed for a given situation are very forgiving of errors in estimated quantities and of operational upsets. Additionally, they are easily changed to give the exact results required. The purpose of this project is to optimize the geometry of steam jet ejector used for refrigeration application in chemical plant. Exhaustive survey has been conducted on the influence of geometrical parameters on the efficiency of the ejector as well as critical flow parameters to improve the overall performance. The use of computational dynamics has been widely adopted by researchers to improve the performance of jet ejector. CFD provides detail insights on the flow characteristics, which allows accurately optimizing the ejector geometry. Since the ejector requires single point design for specific applications, using computer simulations early in the design process will significantly reduce the requirement of prototyping trials. Utilizing the benefits the CFD offers, the dimensions of the ejector system has been measured, which will be further utilized to develop a computational domain and perform numerical iterations to obtain fluid flow characteristics. The results obtained through CFD analysis will be used to optimize the geometry of the ejector, to achieve better efficiency by reducing pressure drop across the ejector geometry.

Keywords: Mixing chamber, fluid domain heat transfer, pressure plot, velocity plot, CFD simulation

I. SELECTION OF EJECTOR MODEL

The ejector model has been selected from a steam jet refrigeration system developed for a chemical processing plant. The operating conditions and geometrical dimensions are described in the table and figure below respectively:

Table 1:
 Design Data

Sr. No.	Particulars	Unit	Value
1	Primary Fluid Suction Pressure	TORR	25.0
2	Primary Fluid Suction Temperature	°C	43.43
3	Suction Level (Air)	Kg/hr	25.49
4	Suction Level (Water Vapor)	Kg/hr	36.03
5	Motive Steam Pressure	Kg/cm ²	6.0
6	Cooling Water Temperature	°C	32
7	Primary Discharge Pressure	TORR	175



Fig. 1: Dimensional parameters.

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