Effect of Impeller Configurations on the Performance of Self-priming Vacuum Pump

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Long Abstract

Introduction

Self-priming vacuum pump is hybrid-type pump of which the principles of axial-type screw vacuum pump and centrifugal pump are combined for obtaining the better performance The schematic of self-priming vacuum pump is shown in Fig. 1. It is operated by the rotation of inducer-impeller generating partial vacuum and centrifugal force. Due to its unique operating principle, self-priming vacuum pump is characterized for transferring working fluid and is able to be used in various industrial fields treating viscous fluids such as slurry. In this study, the effect of impeller configurations on the performance of self-priming vacuum pump with various working fluids was numerically investigated and the proper model providing best performance was suggested.

1. Methods

In order to investigate the flow characteristics and performance of self-priming vacuum pump, 3-D model of self-prming vacuum pump was inversely designed from the 2-D plan and the fluid domain for numerical analysis was extracted by ANSYS Design Modeler ver. 16. Grid systems

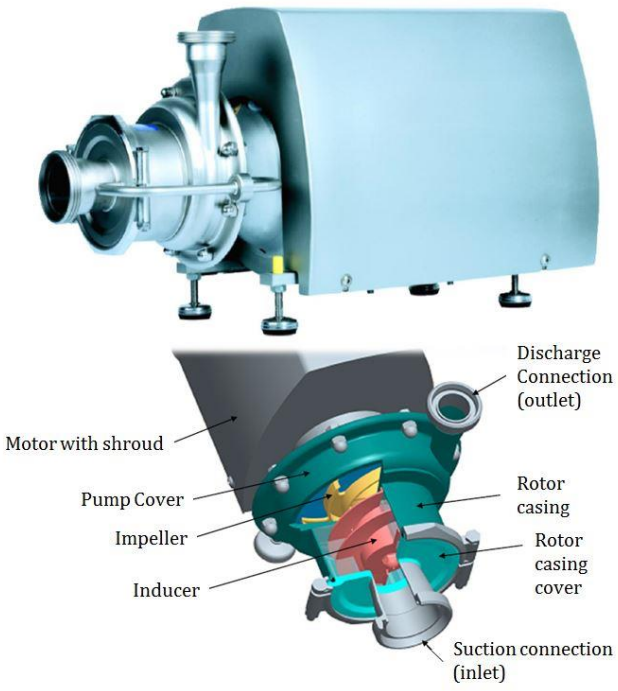

Figure 1. Schematic of the modeled self-priming vacuum pump

were generated by applying hexahedral grids for the rotor region (inducer-impeller) and tetrahedral grids for the stator region (pump casing). Numerical analysis was conducted for various impeller configurations and working fluids having different viscosities by ANSYS CFX ver. 16 adopting MRF (Moving Reference Frame) method and the SST (Shear Stress Transport) model was employed as turbulence model [1].

Reference

[1] F. R. Menter, “Two-Equation Eddy-Viscosity Turbulence Models for Engineering Applications”, AIAA Journal, 32(8): 1598-1605, 1994.