PARAMETRIC STUDY AND OPTIMIZATION OF CENTRIFUGAL PUMP IMPELLER BY VARYING THE DESIGN PARAMETER USING COMPUTATIONAL FLUID DYNAMICS: PART I

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ABSTRACT

In this study, the characteristics of low specific speed centrifugal water pump are presented. The characteristics are evaluated by studying the relationships among the impeller eye diameter, vane exit angle and width of the blade at exit. As these pumps are of Non-positive type, the discharge is greatly affected by any resistance to flow, outlet conditions and design parameters of impeller and casing. Therefore it is necessary to find out the design parameters and working conditions that yield optimal output and maximum efficiency with lowest power consumption. This paper is devoted to the performance evaluation of a centrifugal pump for the given specification. Different pump models are developed by varying critical design parameters to different levels. Response surface method is used for Experimental Design (DoE). Computational Fluid Dynamics (CFD) analysis is carried out on the developed models to predict the performance virtually and to verify with the experimental result of the pump. Optimal pump design is formulated using Response surface method. The objective functions are defined as the total head and the total efficiency at the design flow-rate.

KEY WORDS: Centrifugal Pump; Impeller; Doe; RSM; CFD.