INTERACTION OF IMPELLER AND GUIDE VANE IN A SERIES-DESIGNED AXIAL-FLOW PUMP

A.Karikh – *group HMm-31*

Axial-flow pumps or propeller pumps allow fluid to enter the impeller axially. The impeller can be driven directly by a sealed motor in the pipe or mounted to the pipe from the outside, or by a right angle drive shaft that pierces the pipe. These pumps discharge fluid nearly axially, pumping the liquid in a direction that is parallel to the pump shaft. Axial-flow pumps are typically used in high-flow rate, low-head applications.

For the series design of the impeller, the impeller meridional view was chosen as an arc type and the blade angle of the impeller was designed as an airfoil type. The guide vane of axial-flow pump was designed by analyzing the exit shape and flow-field of the optimally designed impeller. The meridional view of the guide vane was designed by analyzing the hub-tip ratio of the impeller and vane plane development was used in determining the blade angle.

The interaction between the optimally designed impeller and the guide vane was analyzed using the performance curve, which shows the performance of the axial-flow pump depending on the number of blades as well as the setting angle of the impeller. The performance curve map according to the change of setting angles and the number of blades was predicted in the optimum design model of the impeller.

Designing an axial-flow pump consists of designing the impeller and the guide vane. Series designing has been performed for theimpeller. The impeller series design makes it possible to choose the ideal impeller shape that satisfiesvarious flow rate and head requirements by changing the impeller setting angle and the blade numberon the impeller. For the series designing of the impeller, the design variables of the impeller meridional plane were defined as arc type and the design variables of the blade angle of the impellerwere defined as airfoil type. The guide vane of the axial-flow pump was designed by analyzing the exit shape and flow-field of the optimally designed impeller. The meridional plane of the guide vane was designed by analyzingthe hub-tip ratio of the impeller, and vane plane development was used in defining the blade anglevariables of the guide vane because it describes the blade angle distribution simply. The number of impeller blades from the previous study was 2. However, it was changed to 3 here because this design was considered to have more advantage in the market. Since the design-flow rate does not change when the number of blades is 3, the guide vane was designed according to the design flow rate that was used in the impeller design

The three-dimensional shape of the impeller and guide vane has been generated using the ANSYS CFX Blade Gen program. The structured grid system has been generated using ANSYS CFX-Turbo Grid, which is a fluid machinery grid generation program. The influence of the design variables of the axial-flow pump impeller and guide vane on performance has been studied. The optimization model could be induced using the design variables affecting performance. The performance map in accordance with the setting angle and the number of the blades of the impeller also could be described.

1 Our own axial-flow pump could be designed using well-formulated design variables of the impeller and guide vane.

2 The importance of the design variables that affect the performance could be understood using a 2k factorial.

3 The optimization process has been performed to the variables that have a large influence on the total head and the total efficiency using the response surface method.

4 The interaction between the optimally designed impeller and guide vane could be analyzed, as well as the tendency of the head and the efficiency curve in accordance with the alteration of the setting angle and the number of the blades of the impeller.

5 By describing the performance map in accordance with the setting angle and the number of the blades of the impeller, the possibility of series designing the axial-flow pump could be confirmed.

S.Mikhno – *E L Adviser*

Соціально-гуманітарні аспекти розвитку сучасного суспільства : матеріали Всеукраїнської наукової конференції викладачів, аспірантів, співробітників та студентів, м. Суми, 21-22 квітня 2014 р. / Відп. за вип. О.М. Сушкова. — Суми : СумДУ, 2014. — С. 396-397.