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An Effective Impeller Design for Pump

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ABSTRACT
The impeller of a centrifugal pump plays an important role because it determining the flow rate and efficiency of the pump. The efficiency of the pump is determined by the design of the impeller design. Under filing is one of the method for removing material from the underside of the impeller vane at the exit. Under filing also increases the pump head. The design involves having a blade height that is lower than the nominal impeller diameter, which can lead to reduced power consumption, improved flow characteristics, and decreased noise and vibration compared to traditional impellers. The design of under filing impeller vanes can be optimized by various parameters, such as the blade angle, blade thickness, and number of vanes. Computational fluid dynamics (CFD) simulations and experimental testing can be used to optimise the design and ensure proper performance. The modified impeller should then be installed in a test rig that replicates the operating conditions of the pump or compressor. The test rig should be equipped with suitable sensors to measure flow rate, pressure, temperature, and power consumption. The performance of the modified impeller should be compared to that of the baseline impeller, and the improvement in efficiency should be quantified.
Keywords— Flow characteristics, Image Efficiency, Computational fluid dynamics (CFD)

1. Introduction

An impeller is a key component in many fluid handling applications, including pumps, mixers, and agitators. Its primary function is to impart energy to the fluid, generating the flow necessary to perform the intended operation. The impeller vane design plays a critical role in determining the performance characteristics of the impeller, include.ng flow rate, head, and efficiency. One specific type of impeller vane design is the underfilling impeller vane.
This design can lead to a reduced power consumption, improved flow characteristics, and decreased noise and vibration compared to traditional impellers. The reduced blade height allows for less frictional drag and less disruption of the fluid flow, leading to lower energy consumption

2. Experimental methodology

Under filing impeller design refers to the process of removing material from the underside of the impeller blades to create a more aerodynamic shape that can increase the efficiency of a pump or compressor. To experimentally test the effectiveness of under filing impeller design, the following procedure can be followed. First, a baseline impeller with standard blade geometry should be manufactured using a suitable material such as cast iron.
Next, the underside of the impeller blades should be carefully machined to create the desired under filing profile. The amount of material to be removed should be predetermined based on the desired level of improvement in efficiency.
The modified impeller should then be installed in a test rig that replicates the operating conditions of the pump or compressor. The test rig should be equipped with suitable sensors to measure flow rate, pressure, temperature, and power consumption. The performance of the modified impeller should be compared to that of the baseline impeller, and the improvement in efficiency should be quantified. This experiment can be repeated with various levels of under filing to determine the optimal design for a given application.

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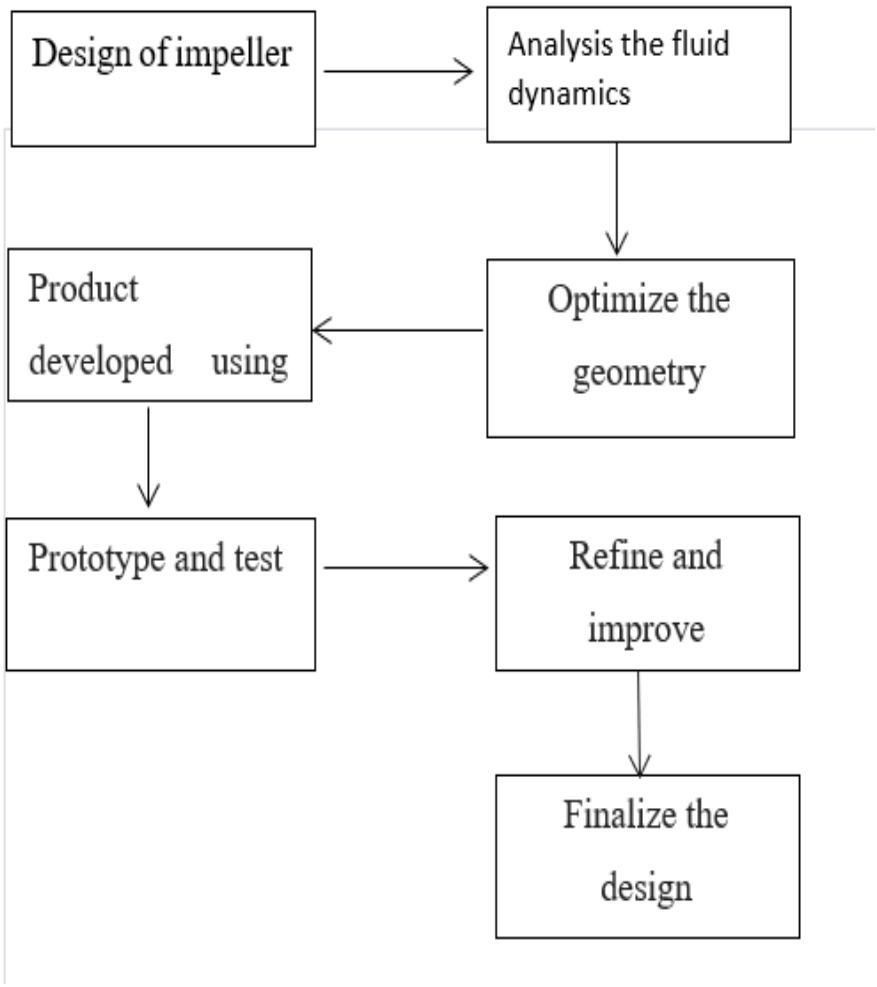

Table1: Specification of Impeller
Before modification

	Blade number	6
	Inlet diameter(mm)	48
	Outlet diameter(mm)	132
	Blade height (mm)	7.5
	Blade thickness(mm)	4.5
	Blade inlet angle	26
	warp angle	126

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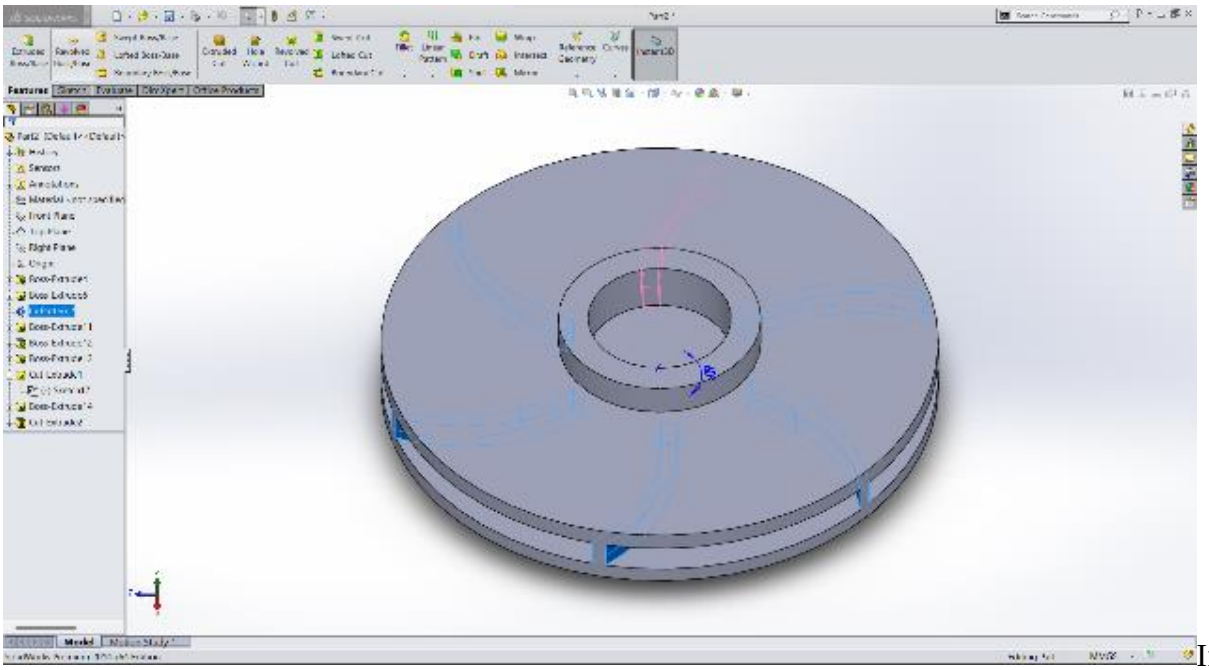

Image :1 Impeller Design

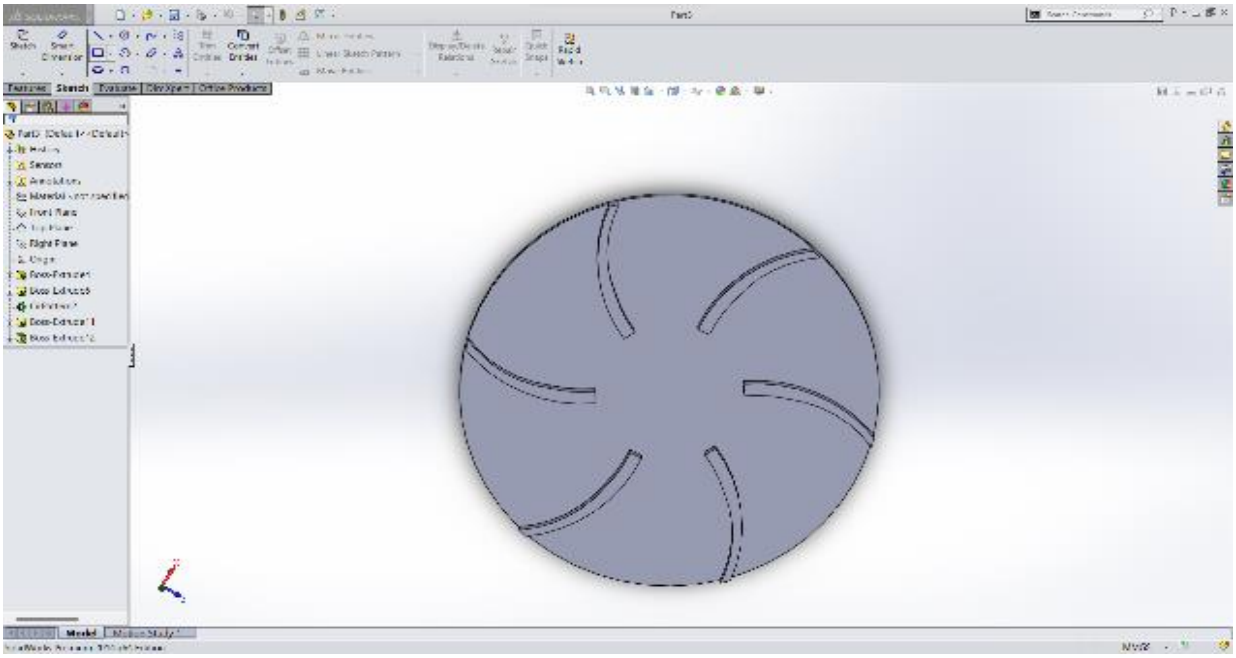

Image :2 Vane Design

1.	Blade number	6
2.	Inlet diameter(mm)	48
3.	Outlet diameter(mm)	132
4.	Blade height (mm)	7.5
5.	Blade thickness(mm)	4.5
6.	Blade inlet angle	24
7.	warp angle	126

Table2: Specification of Impeller After modification

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3. Result and Discussion

The underfiling process of impeller vanes is an important step in the manufacturing of pump impellers. It involves removing a small amount of material from the vane surface to achieve the desired shape and performance characteristics. However, if this process is not performed correctly or if too much material is removed, it can lead to under filing, which can have a significant impact on pump performance. In this study, we investigated the effects of under filing on the performance of impeller vanes and discussed potential causes and solutions for this issue.

4. Conclusion

In conclusion, the performance and pressure head of the impeller also increased. The design and analysis methods are useful to generate performance and flow predictions. Therefore, the design can be optimized to reduce energy consumption, increase pump Head. Under filing of impeller vanes trailing edge is the very convenient practical solution to improve pump performance. By trimming energy added to impeller will also decrease so power requirement of impeller will also decrease.

5. References

Subash K 1* , Muthukumar K , Design and Analysis of Centrifugal Impeller, Journal of Industrial Mechanics Volume 4 Issue 2

Farah Elida Selamat-1* Wan Hariz Iskandar Wan Izhan-1, Design and Analysis of Centrifugal Pump Impeller for Performance Enhancement , Journal of Mechanical Engineering Vol SI 5(2), 36-53, 2018

Ming-Gao Tan, Xiang-Hui He, Hou-Lin Liu, Liang Dong & Xian-Fang Wu (2016) Design and analysis of a radial diffuser in a single-stage centrifugal pump, Engineering Applications of Computational Fluid Mechanics, 10:1, 500-511, DOI: 10.1080/19942060.2016.1210027

Xiangdong Han 1,2,3, Yong Kang 1,2,3,4,*, Deng Li 1,2,3 and Weiguo Zha, Impeller Optimized Design of the Centrifugal Pump: A Numerical and Experimental Investigationo 5

1Manan B. Raval, 2Amit D. Modi 1Lecturer, 2Lecturer, Investigation on Under-filing of impeller vanes to improve the Performance of Centrifugal Pump, © 2017 IJEDR | Volume 5, Issue 4 | ISSN: 2321-9939

Yu-Tai Lee,1 Vineet Ahuja,2 Ashvin Hosangadi,2 Michael E. Slipper,3 Lawrence P. Mulvihill,1 Roger Birkbeck,2 and Roderick M. Coleman, Impeller Design of a Centrifugal Fan with Blade Optimization, Hindawi Publishing Corporation International Journal of Rotating Machinery Volume 2011, Article ID 537824, 16 pages doi:10.1155/2011/53782

Hudson Daniel Raj.E, Kalaimani.T, Investigation of Key Impeller Parameters of Centrifugal Pump Using CFD, International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 10, October - 2013 IJERT ISSN: 2278-018.

Pranit M. Patil1, Shrikant B. Gawas2, Priyanka P. Pawaskar3, Dr. R. G. Todkar, Effect of Geometrical Changes of Impeller on Centrifugal Pump Performance, International Research Journal of Engineering and Technology ,Volume: 02 Issue: 02 | May -2015

HrvojeKozmago,Sutlovi, Improving centrifugal pump efficiency by impeller trimming, Volume 249, Issue 2, 15 December 2009, Pages 654-659.

Peijian Zhou, Jiaxin Tang, Jiegang Mou, Effect of impeller trimming on performance, Volume 2016, Issue 9, September 2016, Pages 38-41