Design And Optimization of Impeller of Centrifugal Blower With Inconel-740

Prof. Adil Shaikh[1], Kunal Arekar[2], Prathamesh Bhilare[3], Yadnyesh Chaphalkar[4], Abhijit Shinde[5]
[1, 2, 3, 4, 5] Trinity Academy of Engineering, Kondhwa, Pune. 411048

Abstract- *Blower is used to deliver theair or gas with an appreciable rise in pressure again the flow resistance. It is an important role in various industries for air-conditioning system, furnace and dust or fume extraction system. Based on the input data the design calculation is been carried out and modelling using catia. The cleanup and meshing are carried out on the ansys workbench. The main aim of the project is increase energy efficiency and constant airflow by optimizing and using Inconel 740. This will provide optimized design for centrifugal blower this paper give the solution to above problem by optimization of centrifugal blower impeller by static and modal analysis using FEA for the material Inconel 740*

Keywords- optimized design of impeller, Module Analysis, centrifugal blower

I. INTRODUCTION

Vibrations are observed in all equipment and structures subjected to dynamic loading. Industrial air blowers are used in various process equipment like dryers, evaporators, providing draft for boilers. The impeller receives the energy from the rotating shaft and transmits it to the air imparting it velocity with slight increase in pressure energy. Blowers are important in providing proper draft to the boiler, which will have an impact on the efficiency of the boilers, as adequate air is supplied to the combustion chamber to ensure proper combustion of the fuel. The principle involved in the design of a blower is similar in virtually every important aspect as that of a centrifugal pump except for the fact that the term "centrifugal pump" is often associated with liquid as its working fluid while the blower is meant to work on air.

II. LITREATURE REVIEW

Milind U. Karanjkar et al., 2017 the problem indicated at their end for air blower were Heavy corrosion on the impeller due to corrosive environment & though it complies with I.S.-1940 vibration norms, it creates unwanted irritating sound, which can be termed as noise pollution. The root cause of noise pollution is vibration, which is the result of uneven mass distribution and can be termed as manufacturing defects. Secondly, improper clamping of the mating parts can result in vibrations. Vibrations are generally observed when a system or a element which is subjected to dynamic forces which can be periodic or random, linear or rotational.

Ghanshyam. G. Iratkar et al., 2017 Centrifugal pumps are the simplest equipment used in any process plant. Centrifugal pumps are commonly used in processing plants, water supply plants, steam power plants, oil refineries, etc. Its purpose is to convert the energy of an electric motor or turbine into the kinetic energy and then into pressure energy of a liquid that is being pumped. The energy changes take place with the help of two main components i.e. the impeller and the volute or diffuser. The impeller is the rotating component that converts input energy into the kinetic energy. In this paper, a literature survey is done on centrifugal pump impeller and its design and structural/static analysis using FEA Software for different materials.

Dr. Vinayak R. Naik et al., 2018 A design methodology to examine various parameters of the centrifugal blower using computational fluid dynamics approach. The effects of blower geometry, blower speed, impeller geometry, and blade height and impeller diameter have been assessed. Noise level and speed are the output parameters calculated. High rotating frequency of blower produces high level of noise. Thus, noise reduction is key parameter in design of hand blower. Using Computational fluid dynamics (CFD) noise source is analyzed. A different combination of blower geometry, impeller diameter, blade height, no of blades is carried out and is optimized for noise reduction.

III. PROBLEM STATEMENT

The present centrifugal blowers are manufactured from MS material; here corrosion and scale formation due to wet environment could be a major drawback. This corrosion, and scale formation leads to reduce the life and performance of the bower and the corrosive ingredients are mix with food, which is very harmful for human life, conjointly weight of this blower is high and vibrations created by the given centrifugal blower is more.

IV. OBJECTIVES

To study design parameters of impeller of centrifugal blower.

To analyze static and dynamic stability of impeller by varying the thickness and RPM.

To validate the simulated results with experimental results.

To confirm that design is safe for Resonance.

V. SCOPE

This study can be extended for design and optimization of impeller by changing the various performance parameters for the weight reduction and improve the corrosion resistance property. Also prediction of natural frequency with the help of modal analysis by varying the operating parameter

VI. MATERIAL SELECTION

Key feature for the selection of Inconel 740 for proposed work

a) Good corrosion resistance.
b) High temperature strength.
c) Better thermal stability.
d) Good mechanical properties.
e) Cost effective.
f) Less density.

VII. CETRIFUGAL BLOWER

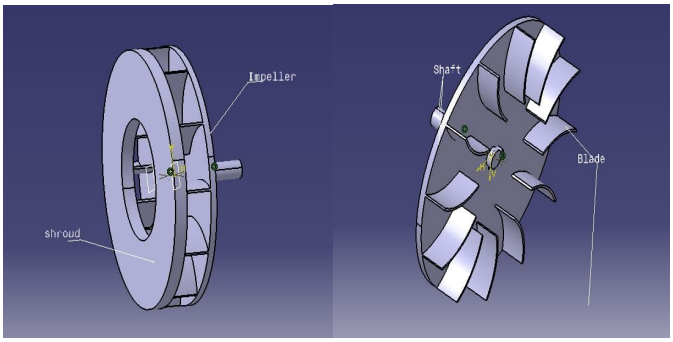

Fig 1.Centrifugal blower

The principle involved in the design of a blower is similar in virtually every important aspect as that of a centrifugal pump except for the fact that the term "centrifugal pump" is often associated with liquid as its working fluid while the blower is meant to work on air. The effects of centrifugal force acting upon the spinning air within the impeller create the suction. As the impeller rotates, the spinning air moves outward away from the hub, creating a partial vacuum which causes more air to flow into the impeller. Air enters the impeller axially through the inlet nozzle which provides slight acceleration to the air before its entry to the impeller. The action of the impeller swings the air from a smaller to a larger radius and delivers the air at a high pressure and velocity to the casing. The centrifugal energy also contributes to the stage pressure rise. The flow from the impeller blades is collected by a spirally-shaped casing known as scroll or volute. It delivers the air to the exit of the blower. The scroll casing can further increase the static pressure of air. The outlet passage after the scroll can also take the form of a conical diffuser

VIII. ANALYSIS

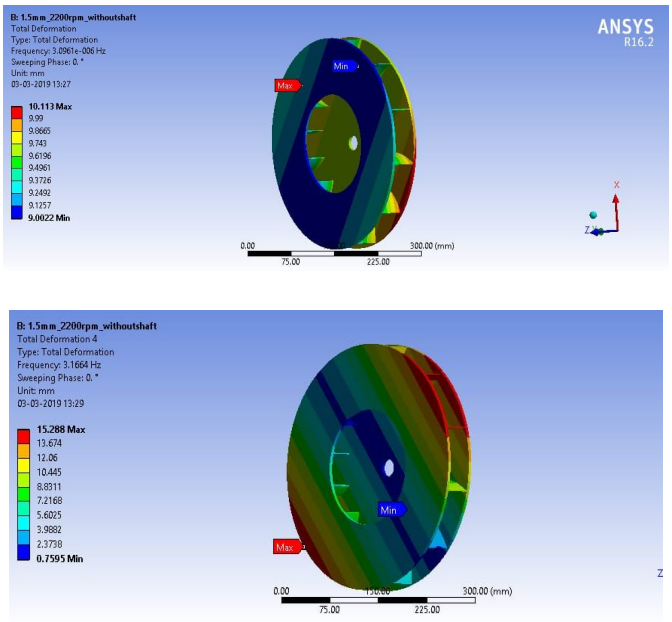

Fig 2. Total Deformation OfCentrifugal blower

REFERENCES

[1] Mr Milind U. Karanjkar, Prof S. H. More,"*Vibration Analysis and Weight Optimization of Impeller for Industrial Air Blower"*, International Journal of Advance Research & Innovative Ideas in Education, Vol-3, Issue-3, 2017, Pages: 2945-2955.

[2] Kay ThiMyaing, HtayHtay Win, *"Design and Analysis of Impeller for Centrifugal Blower using Solid Works"*, *International Journal of Scientific Engineering and Technology Research*, Vol.03, Issue 10, 2014, Pages: 2138-2142.

[3] Dinesh Tare1, VaibhavBhagat&BasavarajTalikotti, *"Static and Dynamic Analysis of Impeller of Centrifugal Blower*", International Journal of Innovative Science, Engineering & Technology, Vol. 3, Issue 5, 2016, Pages: 547-553.

[4] Xiaozhang Qu, Guiping Liu, ShuyongDuan, Jichu Yang, *"Multi-objective Robust Optimization Method for the Modified Epoxy Resin Sheet Molding Compounds of the Impeller"*, Journal of Computational Design and Engineering, Vol. 3, 2016, Pages: 179-190.

[5] AdekunleTaofeekOyelami, OlawaleOluwadareOlaniyan, DalyopIliya and Abimbola Samson Idowu, *"The Design of a Closed-Type-Impeller Blower for a 500kg Capacity Rotary Furnace"*, Assumption University Journal of Technology, Vol. 12(1), 2008, pages: 50-56.

[6] Ghanshyam G. Iratkar, A. U. Gandigude, *"A Review on Static analysis and Material Optimization Using FEA of Centrifugal Impeller"*,International Journal of Advance Research, Ideas and Innovations in Technology, Volume 3, Issue 3, 2017, pages: 1566-1569

[7] *Investigation of Forward Curved, Backward Curved and Radial Blade Impellers of Centrifugal* V. S. Thangarasu, G. Sureshkannan, N. V. Dhandapani, *"Design and Experimental Blower"*, Australian Journal of Basic and Applied Sciences, 9(1), 2015, Pages: 71-75.