

Weight reduction of radial fan impeller using ANSYS

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This paper deals with optimizing the design of radial fan impeller using finite element analysis. Most manufacturing concerns spend more than a 60% of their money for materials, i.e., material soak up substantial portion of the capital invested in an industrial concern. This emphasizes the need for adequate material management because even a small saving a material can reduce the production cost to a fair extent and thus add to the profits.

The purpose of this optimization problem is to minimize the weight of the radial fan without exceeding the allowable stress. To define variables, we need to know which variables have an effect on the variable to be minimized. As the mass of the fan is directly related to the thickness of the impeller parts hence our objective in this project is to minimize the thickness, keeping in consideration the operating restrictions and design parameters.

To ensure the desired performance while considering the significance of physical operating situation for a radial fan, a full fledged Finite Element Analysis (FEA) has been carried out for the prediction of natural frequency of the rotor system, stress distribution and strain energy distribution of the rotating impeller. The Ansys/Multiphysics package was used for the structural analysis.

The analysis was carried out using the default thickness of the impeller of the radial fan. This results in massive weight of the fan, leading to large vibrations and one of the reasons to failure. Ways were found out to reduce all these things, so the analysis was carried using various reduced thicknesses of the impeller and the optimum thickness of the impeller parts found for the safe stress and strain limits. This value analysis/Engineering results in material reduction, cost reduction with reduced vibrations for the desired design and operating conditions. The basic procedures and issues involved in the FE Analysis of a radial fan are also outlined. The design configuration of the radial fan has been provided by BHEL, Boiler Auxiliaries Plant, Ranipet.