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# Design and Structural Analysis of Steam Turbine

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**Abstract:** Now a days, power production is one of the important think. Day by day the electricity is usage increased. But electricity production is not increased. There is various kind's power production available. They mainly two types, one is renewable energy and another one is non renewable energy. In this project, we will select the non renewable source its namely steam turbine. In this project we will design and strength analysis the steam turbine with various materials. And also compare the various materials strength, weight and cost. The steam turbine is designed by the SOLIDWORKS Software. And ANSYS Software is used for analysis the steam turbine.

**Key words:** SOLIDWORKS, steam turbine, renewable, ANSYS, structural, production

## INTRODUCTION

Steam turbine is an exceptionally modern hardware. Its every single part is outlined by doing a great deal of figurings and investigations. The primary segment of a steam turbine is its rotor, it is the part which is both under warm and mechanical anxieties. The poles utilized as a part of steam turbines can be both empty or strong. Beforehand shafts were made empty because of producing deserts. Amid fashioning every one of the debasements gathered in the center of the pole because of this there was shot of break development and disappointment of shaft. Be that as it may, nowadays because of change in manufacturing strategies and blame identification techniques the contaminations in the center can be made almost no, i.e., inside middle of as far as possible. It has lessened a considerable measure of issues for example, machining cost and time, scrap, firmness and worry in the rotor shaft. So, in the present circumstances enterprises began utilizing strong produced shafts for their turbine rotors and in this study we will think about the two shafts on different viewpoints utilizing limited component investigation.

## MATERIAL AND METHODS

The properties of component are characterized which are the properties of the material of the rotor. The youngs modulus is taken as -2.11×1011 and poissons proportion is taken as 0.3. Thickness of material taken as 7850 kg/m$^3$. Length of rotor as 5.44 m.

To supplant the current empty rotor shaft with a strong shaft and discover the preferred standpoint/weakness of doing as such. We need to perform different estimations on radial burdens, torsional loads. Thermal burdens and core abandons for the correlation. At the point when a steam turbine rotor pivots at 3000 rpm the edges apply a divergent draw on the rotor plates. In the event that the plates are incorporated to the pole of rotor at that point there is a lessening long of the rotor and extension in the rotor circles. Presently the turbine is an extremely refined machine in which the clearances between the sharp edges and packaging is low to stay away from steam spillage and productivity misfortune. Keeping in mind the end goal to appropriately outline such fine clearances the mechanical and also warm development of the cutting edges and rotor must be figured precisely. Theoritical computations can give an incentive for extension/constriction, we need to confirm this incentive by FEM examination in which all the genuine requirements are characterized. The aftereffect of the investigation must give the outcomes inside satisfactory scope of hypothetical outcome. Since, the rotor is symmetric about its rotational hub, we utilize axisymmetric demonstrating system to make the model. Subsequent to displaying fitting must be finished with appropriate component shapes and size to get the coveted outcomes. The FE model of IP Rotor of Steam turbine is appeared in Fig. 1.

**Design:** The steam turbine rotor is designed by using the SOLIDWORKS Software. SOLIDWORKS Software is one of the good software for mechanical components designing (Heckman and Davis, 1998; Bradley and Currie, 2005; Edmonson, 1970). It is very useful for the leaner's and students for 3D modelling. The created steam turbine rotor 3D Model is shown in Fig. 1.

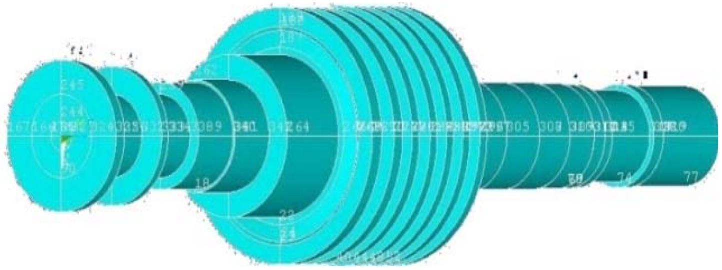

Fig. 1: Steam turbine rotor

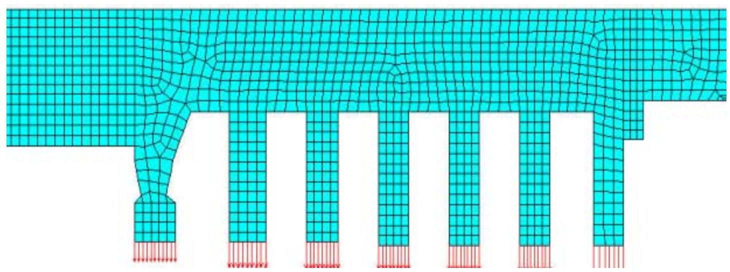

Fig. 2: Mesh

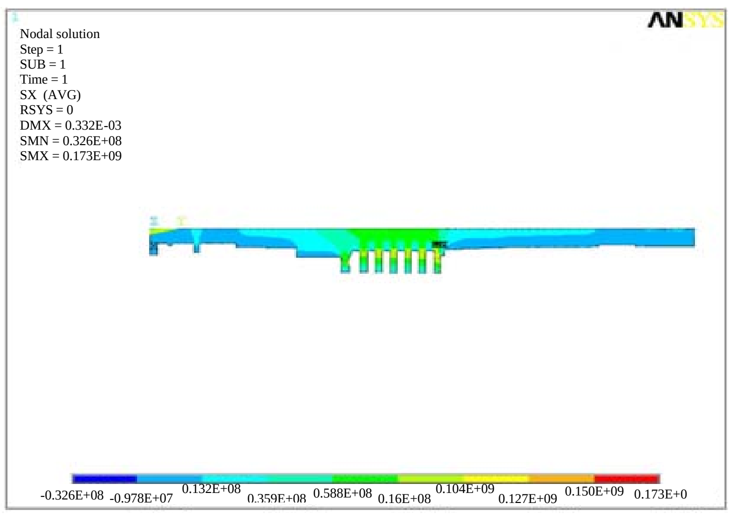


Fig. 3: Stress

**Analysis:** ANSYS is the tool which is used to analysis the steam turbine with various materials. The static structural analysis is selected for analysis the steam turbine rotor. The designed 3D Model of the steam turbine imports to the ANSYS and apply its boundary conditions (Jayakumar *et al*., 2014; Babu *et al*., 2008) (Fig. 2 and 3).

## RESULTS AND DISCUSSION

The consequence of the FEM investigation utilizing Quad component in free work for strong rotor is 0.342 and 0.356 m for empty rotor (Fig. 3). The impact of torsional weight on strong rotor was observed to be 1768 N-m and on empty rotor it is 1761 N-m. In the wake of leading Von Mises investigation the greatest worry in both the rotors was 139 MPa which is lower than the yield quality of compound steel, i.e., in the scope of 367-1894 MPA. So, the plan is alright to engineer reason. The warm temperature conveyance investigation on the two rotors the example of dissemination was same for both. The main phase of sharp edges encounters the most extreme warm stun as the steam encroaches on it with max temperature. Warm extension for the two rotors in relentless state was completed and it was seen that the empty rotor extends by 1 mm more than strong rotor.

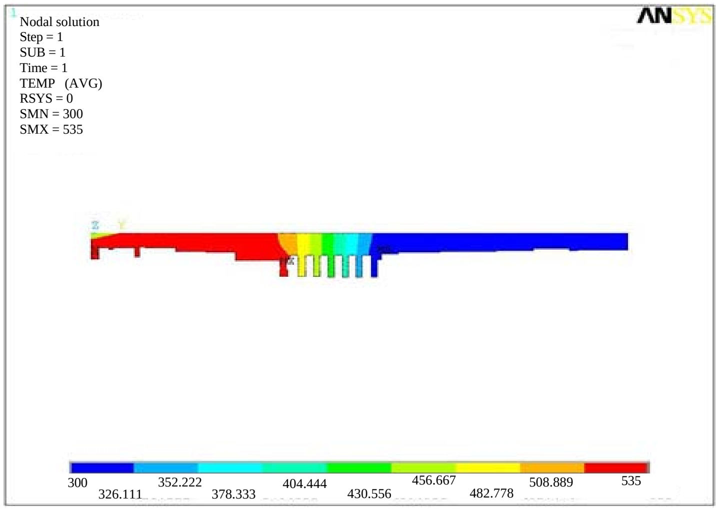


Fig. 4: Total deformation

## CONCLUSION

In this study, the steam turbine rotor is designed by the SOLIDWORKS Software and it is analysed by the ANSYS workbeanch. The ANSYS results of the present material are compared with the existing material. The new proposed material cast iron is more suitable than the existing material mild steel.

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