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Dynamic Analysis of Shrouded Steam Turbine Blade For Investigating Frequency Failure

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Abstract

A turning turbine edge is the section, which changes over the engine imperativeness of the streaming fluid into mechanical essentialness. As such the relentless nature of these edges is basic for the productive activity of a turbine. Turbine sharp edges experience fluctuating forces when they go through non-uniform fluid pour out of the fixed vanes.

The key arrangement thought is to avoid or to restrict the unique nerves made by the fluctuating forces. The mark of the endeavor is to evaluate the tensions occurring in the pack sharp edge of steam turbine in last stage in light of outward powers and steam curving forces.

The sharp edge, root and circle are shown autonomously in ANSYS group and they are amassed using obliged conditions. In the wake of giving the constrain conditions cyclic symmetric assessment conditions are associated and after that static and model examination are finished. After that Campbell and safe frameworks are plotted.

Key Words: *Shrouded steam turbine, frequency, modal analysis, Campbell graphs etc.*

I. STATEMENT OF PROBLEM

In order to improve the reliability and thermal efficiency of mechanical steam turbines, advanced blade design has been developed. The advanced blade designs are typified by the advanced shroud structure. With these designs the blades are continuously coupled by the blade deformation due to centrifugal forces.

By using shrouds packet of blades will be created to do cyclic symmetric analysis. From the packet of blade which was designed sector of one blade was taken and cyclic symmetric analyses are carried out to that blade. After giving cyclic symmetric conditions static and model analysis are carried out for the model and Campbell and safe diagrams are generated at four modes of extraction at different natural frequencies.

II. MODELLING OF PACKET BLADE

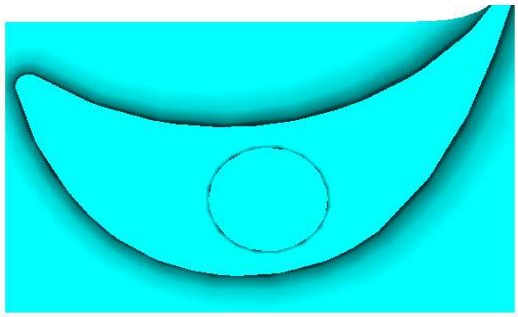


Fig 1 Top view of blade profile

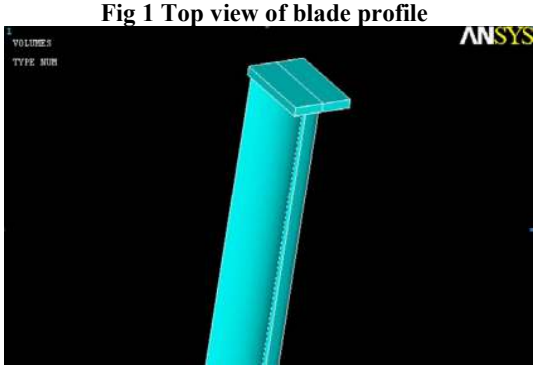


Fig 2 solid model of blade with shroud

III. ANALYSIS

The aim of the analysis is to study of freestanding packeted blade and verification of the results with the experimental results. Using ANSYS package model is generated and mesh generation was done in this package. Modal analysis at cyclic symmetry conditions is done in ANSYS and Campbell diagrams are drawn.

FEM modal details:

- Material: Isotropic
- Modulus of elasticity: 2.0e5 N/ mm^2
- Poisson's ratio : 0.3.
- Density :7.85e-9 Kg/ mm^3

Modal analysis of packeted blade:

The idea of packeted edge examination is to mimic and investigate the single cutting edge area of specific as this structure the fundamental conduct of the modular. Modular investigation is led for the single sharp edge by running at various rpm. The sharp edge is compelled for all levels of opportunity at the foundation of the cutting edge where it is connected to the root and cover. In this examination the pre-focused on impact of the sharp edge is additionally thought of. Because of oneself

weight when the sharp edge is run at various velocities its regular frequencies differs.

IV.RESULTS AND DISCUSSIONS

Subsequent to finishing modal analysis at various working rates we can get frequencies for 3 methods of extraction. Because of these qualities we can draw Campbell charts.

Disfigured and undeformed, Nodal arrangements and Campbell charts for various working rate and normal frequencies are displayed in the underneath figs.

In the current work static and modular investigation are completed at running rate 3000rpm.First static examination was done at various recurrence esteems. Figs. Shows twisted and undeformed states of the sharp edge area model, von mises stress at various frequencies. By this we know most extreme distortion and where the greatest burdens happen. For this model greatest pressure happens where root and plate joins by the pin. Subsequent to finishing static examination at each recurrence esteem we go for modal analysis at running pace 3000rpm with 3 methods of extractions. The normal frequency esteems happen at various rates were displayed in the table.

By these qualities we draw Campbell graph as displayed in graph. By this Campbell graph we see that mode shape lines are not intersection with motor request lines at running rate. Subsequently this model is protected at that running rate with cyclic symmetric conditions.

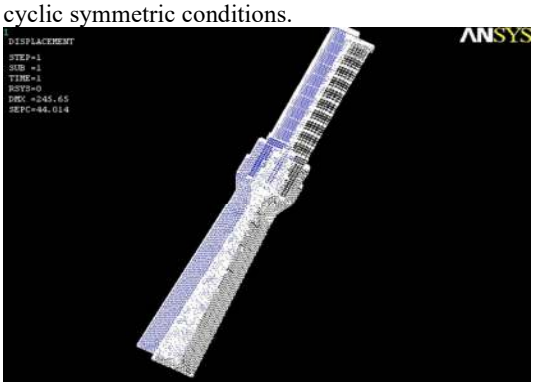


Fig.3 Deform and Undeform shape at 3000rpm

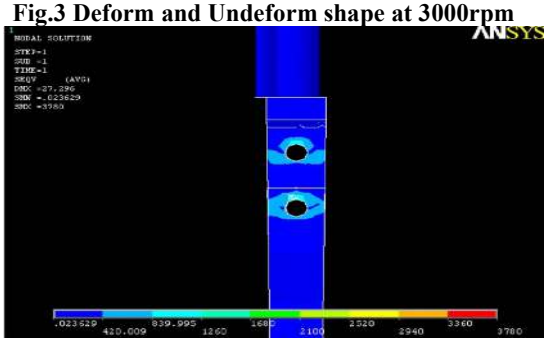
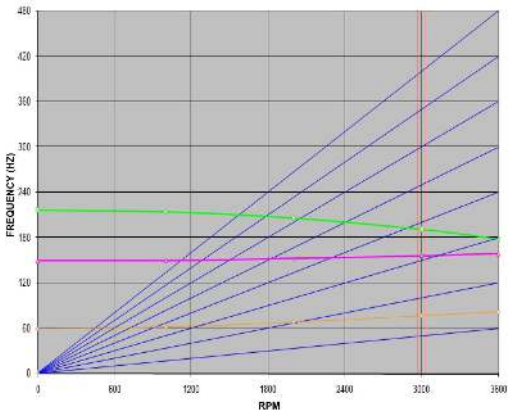


Fig.4 von mises stress for 1000rpm



Graph 1: Campbell graph of blade at different speeds

V.CONCLUSION

The essential objective of this endeavor is to diminish the mistake of steam turbine cutting edge to avoid dynamic weights vibration caused dissatisfactions and shortcoming frustrations.

Showing of packeted steam turbine cutting edge was done. A lone steam turbine edge division from the group was taken and measured examination at different working rates with cyclic symmetric conditions was finished. With ordinary frequencies occurred at different speeds Campbell diagrams are plotted.

VI.REFRENCES

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