STATIC AND MODAL ANALYSIS OF STEAM TURBINE BASE FRAME

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ABSTRACT

The finite element modeling and dynamic analysis of massive and elevated foundation of steam turbine generator is considered. The element type, element size and damping ratio are very important parameters in finite element modeling of massive machine foundation in general and the steam turbine generator foundation in particular. Ineffective modeling of the foundation may result in an unnecessary increase in the foundation size to limit the vibration amplitude within the machine manufacturer specified limits

A detailed finite element model of the steam turbine generation foundation is constructed using three dimensional solid elements model available in ANSYS finite element package. This model is used to achieve the free vibration and forced vibration analysis taking into consideration.

The results of the numerical dynamic analysis performed on the machine foundation for free vibrations, harmonic forced vibrations, as well as seismic response are reported and analyzed in this thesis.

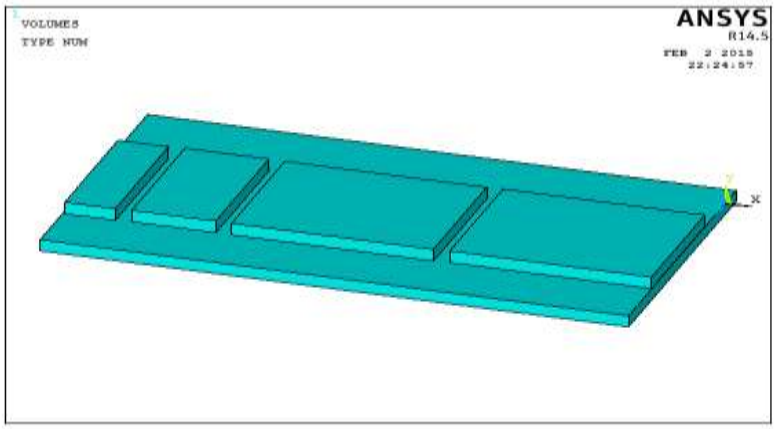
I. INTRODUCTION

The duty performed by an aircraft power plant has generally in the past been monitored by maintaining in a log book the number of hours of aircraft operation. Such records have customarily been used to obtain an indication when it is essential to overhaul the power plant. Not only are such prior art practices subject to error due to inaccuracies in the manual record keeping, but also such methods do not give a reliable indication of the extent of work performed by the aircraft power plant. Further, in some conditions of service, such as when operating in a hostile environment it is not practical to maintain accurate records of aircraft operation.

It has thus been proposed to equip an aircraft engine with a temperature-time integrating counter to provide an automatic and more reliable indication of the actual duty performed by the engine. This improved accuracy results from the fact that the rate of consumption of the operating life of a gas turbine engine is proportional to the product of the temperature at which it operates and the duration of that temperature. While such devices provide improved measure of consumed engine operating life there remains room for improvement for such devices. In particular, other criteria exists on which a judgment may be made as to whether an aircraft engine should be removed for overhaul.

II. STRUCTURAL ANALYSIS OF STEAM GENERAATOR BASE FRAM STEEL

Imported Model of Pro/Engineer



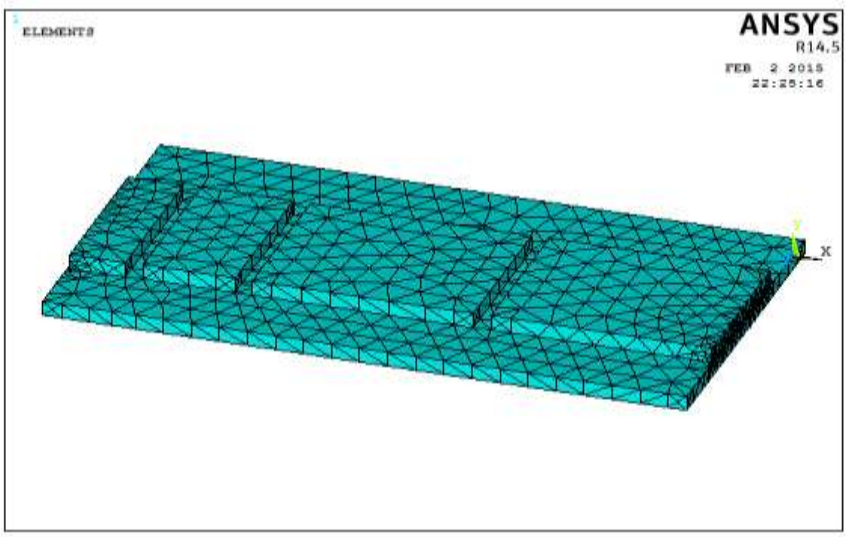
Element Type: solid 20 nodes 186

Material Properties: Youngs Modulus (EX) : 205000N/mm^2

Poissons Ratio (PRXY): 0.29

Density : 0.00000785kg/mm^3

Meshed Model



Loads

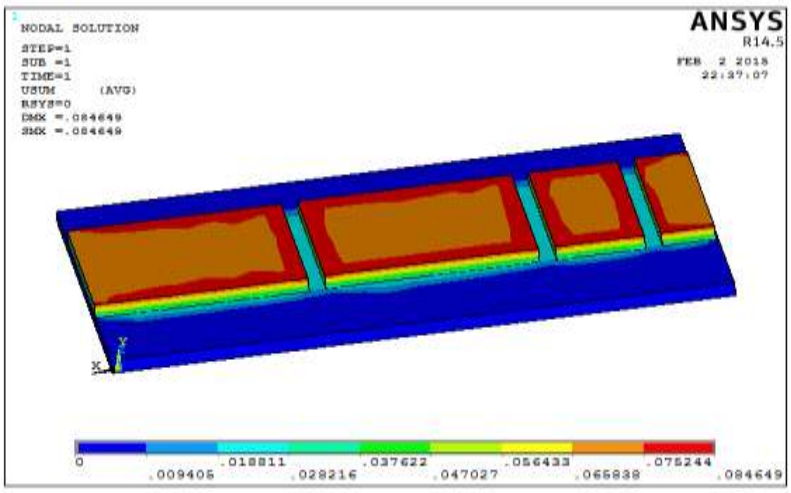
Pressure values –15.5N/mm^2

Solution

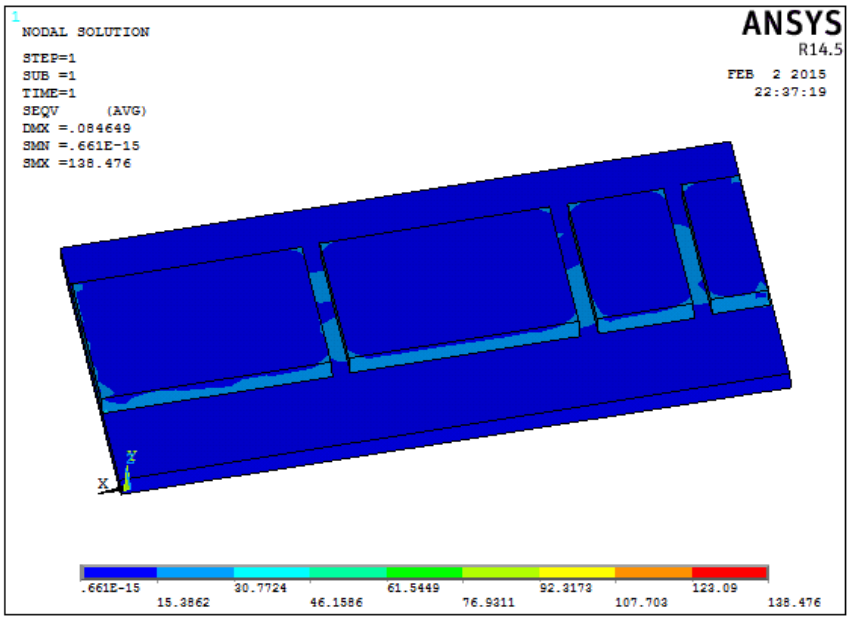
Solution – Solve – Current LS – ok

Post Processor

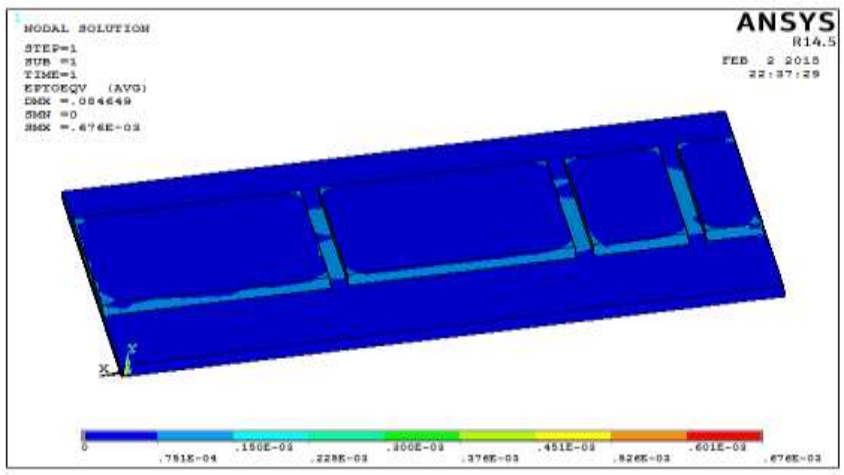
General Post Processor – Plot Results – Contour Plot - Nodal Solution – DOF Solution – Displacement Vector Sum



General Post Processor – Plot Results – Contour Plot – Nodal Solution – Stress – Von Mises Stress

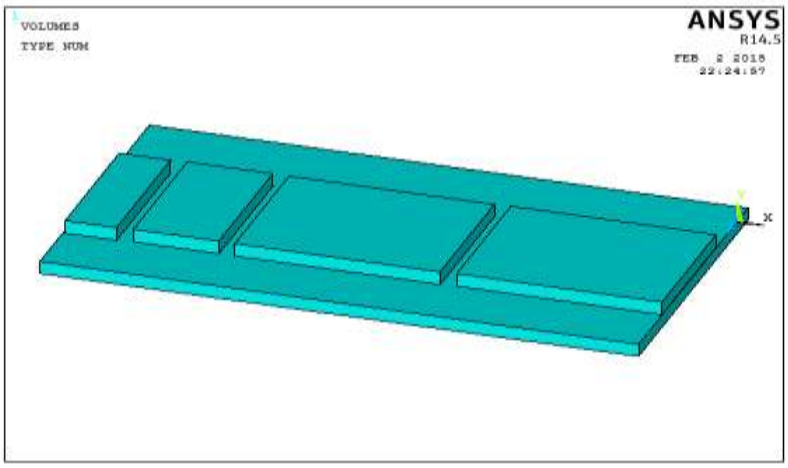


General Post Processor – Plot Results – Contour Plot – Nodal Solution – Strain – Total mechanical Strain



III. STRUCTURAL ANALYSIS OF STEAM GENERAATOR BASE FRAME CAST IRON

Imported Model fo Pro/Engineer



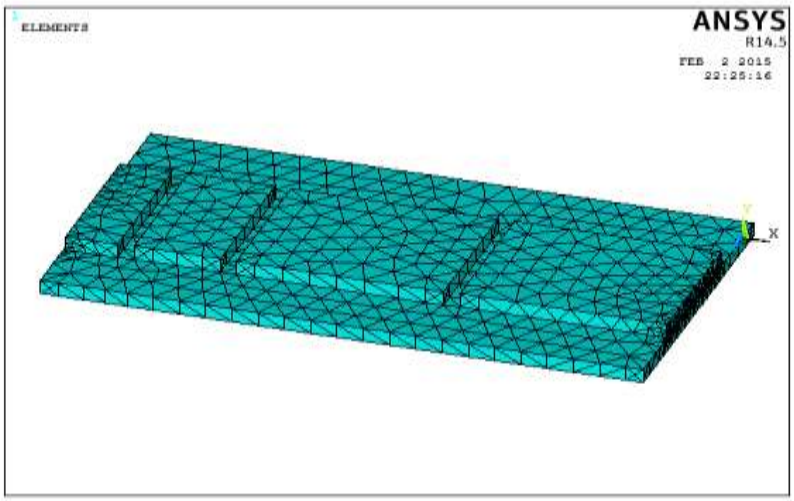
Element Type: solid 20 nodes 186

Material Properties: Youngs Modulus (EX) : 103000N/mm^2

Poissons Ratio (PRXY): 0.211

Density : 0.0000071kg/mm^3

Meshed Model



Loads

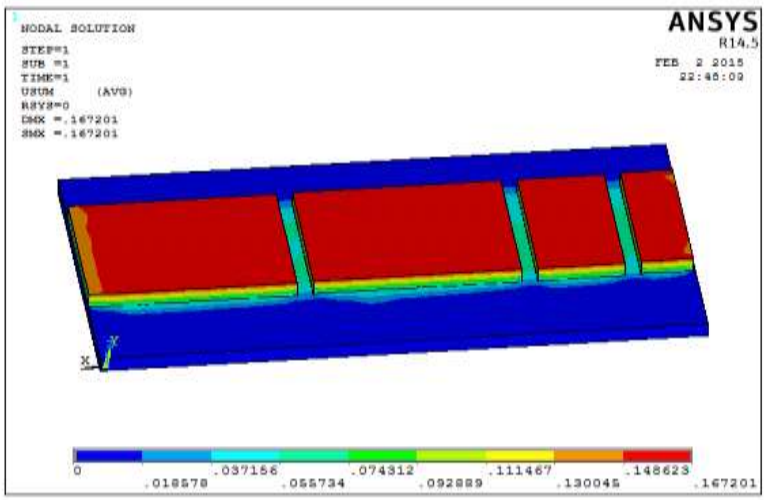
Pressure values –15.5N/mm^2

Solution

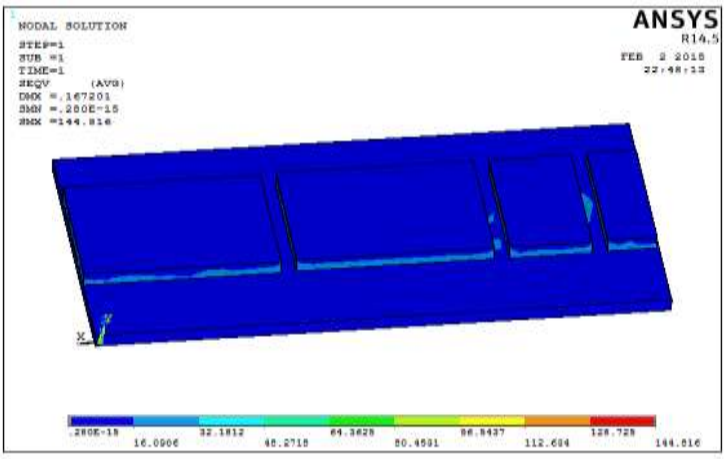
Solution – Solve – Current LS – o

Post Processor

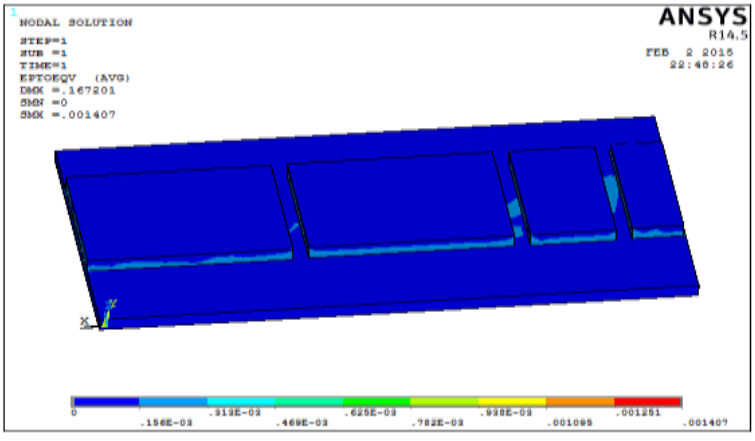
General Post Processor – Plot Results – Contour Plot - Nodal Solution – DOF Solution – Displacement Vector Sum



General Post Processor – Plot Results – Contour Plot – Nodal Solution – Stress – Von Mises Stress



General Post Processor – Plot Results – Contour Plot – Nodal Solution – Strain – Total mechanical Strain



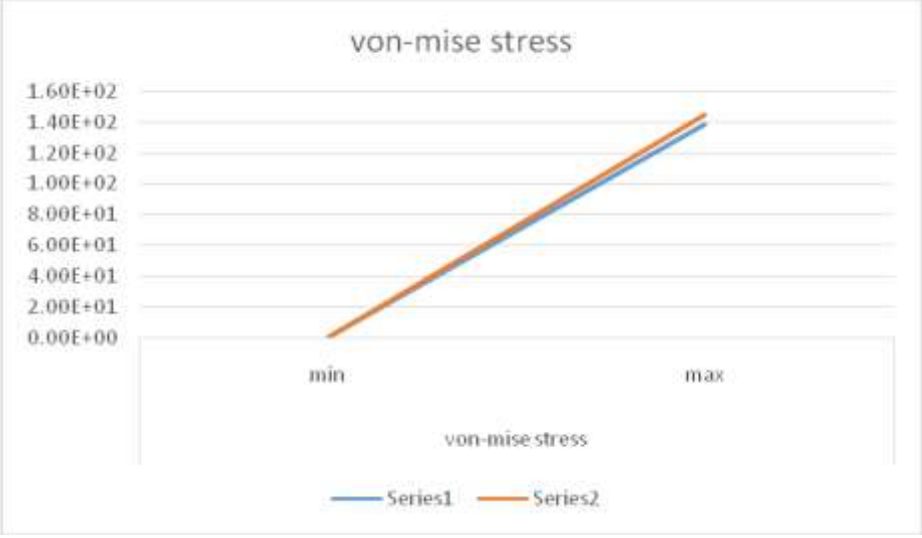
IV. RESULTS & DISCUSSION

The figures that are tabulated below are the results from ANSYS, by observing the results we can identify that steel has more strength as the displacement, von-mise stress and strain are very low when compaired to cast iron, for better understanding these values are ploted into graphs below

S.No	Material	Displacement		Von-Mise Stress		Strain	
		Min	Max	Min	Max	Min	Max
1	Steel	0	0.08464	6.61e-16	138.476	0	6.76e-04
2	Cast Iron	0	0.167201	2.80e-16	144.816	0	0.001407

Table 1

Graph1



Graph 2

V. CONCLUSION

After going through the results obtained we conclude that steel is the best material to fabricate the base plate for gas turbines, cast iron may not with stand the loads of gas turbine as steel does

REFERENCES

[1] "Flywheels move from steam age technology to Formula 1"; Jon Stewart | 1 July 2012, retrieved 2012-07-03
[2] **Jump up**^ [2], "Breakthrough in Ricardo Kinergy 'second generation' high-speed flywheel technology"; Press release date: 22 August 2011. retrieved 2012-07-03
[3] Janse van Rensburg, P.J. "Energy storage in composite flywheel rotors". University of Stellenbosch.
[4] **Jump up**^ rossetaTechnik GmbH, Flywheel Energy Storage, German, retrieved February 4, 2010.
[5] Zhang Da-lun, Mechanics of Materials, Tongji University Press, Shjanghai, 1993
[6] Huang Xi-kai, Machine Design, Higher Education Press, Beijing, 1995
[7] Robert L. Norton, Design of Machinery, McGraw-Hill Inc, New York, 1992
[8] K. Lingaiah, Machine Design Data Handbook, McGraw-Hill Inc, New York, 1994
[9] R. S. Khurmi, J. K. Gupta, Machine Design, Eurasia Publishing House, NewDelhi, 1993
[10] ANSYS User's Manual, Swanson Analysis Systems, Inc., Houston

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