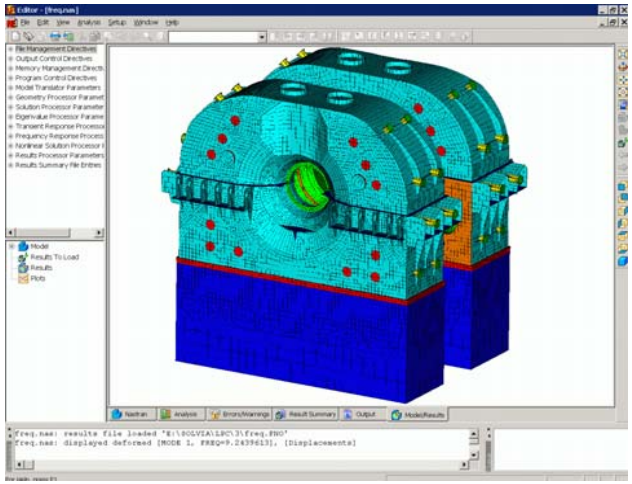
Industrial Case Study (CKTI-Vibroseism, Russia – Power Plant Turbines)



The Joint Stock Company Leningradsky Metallichesky Zavod (LMZ), St. Petersburg, Russia, produced numerous high-speed low-pressure steam turbines (3000 rpm) for many Eastern European countries. Up until the last decade, only simplified structural analyses were available due to the complicated overall structure and internal parts of this class of turbine.

Recently, however, CKTI-Vibroseism (St-Petersburg, Russia), performed a finite element analysis on these types of turbines using NEi Nastran's capabilities (left). This analysis included detail geometry of the turbine itself and the vibration and seismic isolation systems within the turbine's pedestal under a full range of dead and live operational, accidental and seismic loads, like a high pressure outside the pipeline's operational and seismic loads.

The following steps were followed to solve the problem of the turbine's seismic qualification. First, detailed finite element models of the turbine's high and low pressure parts and rotor system with bearings were created, and from these, simplified models were developed for inclusion into the coupled model of the system: "Building – Vibroisolation Pedestal – Turbine" (BVT). Next, an analysis of the coupled model (BVT) was done. This included consideration of soil-structure interaction using existing soil conditions. Three components of time history acceleration were used to define seismic excitation.

As a result of the BVT system analysis, a full picture of time history displacements and loads were correctly determined, as well as a solution to a problem of rotor gaps. In the final step determined loads were applied to the detailed model of turbine for seismic qualification of the whole structure.

At present, LMZ manufactures steam turbines under individual customer's requirements and is upgrading the 200 and 300 MW steam turbines using FEA analysis. This made possible an increased efficiency by 5-7% and increased capacity by 10-13% of the steam turbines.

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For more information about our company or our products, please contact:

Headquarters:

NEi Software, Inc.
5555 Garden Grove Blvd., Suite 300
Westminster, CA 92683-1886
USA
Phone: +1.714.899.1220
Fax: +1.714.899.1369
Email: info@neisoftware.com
Website: www.NEiSoftware.com

Europe:

NEi Software EMEA Office
The Old Barrel Store
Draymans Lane, Marlow
Buckinghamshire, SL7 2FF
United Kingdom
Phone: +44.0.1628.400.645
Fax: +44.0.1628.891.701
E-mail: emea@neisoftware.com
Website: www.NEiSoftware.com/emea

Asia:

NEi Software Asia Office
Shinjuku Park Tower
N30th Floor 3-7-1 Nishi-Shinjuku
Shinjuku-ku, Tokyo, 163-1030
Japan
Phone: +81.03.5326.3062
Fax: +81.03.5326.3001
E-mail: asia@neisoftware.com