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DIAGNOSTIC APPLICATIONS FOR GCN-317 TYPE COOLING PUMP.

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In the nuclear power plants (NPPs) with pressurized water reactor (PWR) a number of vibration problems caused by main cooling pumps (MCP) are encountered, which influence economic aspects. Their timely identification will decrease the repair times and consequently economic loss, caused by the non-production of electricity.

One of the attempts to solve this problem could be the computational simulation of the MCP failures used after for identification of the failures by a comparison of the simulated and real behaviour of the engine. Realization of such an attempt, supported by the European Commission for the Competitive and Sustainable Growth Programme and by UJV Rez a.s. by means of Project IRMA, is described in this article.

The tasks were stated as follows:

- Computational model development
- Baseline measurements of the pump behavior
- Pump failures modelling and validation
- User environment development
- Testing of the developed product at NPP

For the pump modelling the FEM and particularly the use of ANSYS software was chosen. Responsible team for the project:

- UJV Rez a.s. - main developer

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  - Computational model development
  - User interface development
- NPP Dukovany - subcontractor
  - Analysis of Possible Failures
  - Baseline measurements on-site
  - Testing and demonstration place

The model was created using ANSYS⁄s Rotordynamic module, where shaft was simulated by beam elements and disks by pipe elements. The journal bearings were simulated by spring/damper elements, where damping is determined experimentally and stiffness computed based on the oil/water and journal geometry properties. Main failures simulated:

- Imbalance of the pump = force at f0
- Shaft misalignment = rotating bending moment + force at f0 and 2f0
- Cracked shaft = bending of shaft
- Eccentric rotor = pulsating vibrations near 2f0

Model validation:

- Tuning towards results of the analysis of measurements done on site under
  - Operational and
  - Start-up and shut-down conditions
- On-line comparison with the operational vibration shapes
- Comparison with the qualitative simulation made in the laboratory.