Politecnico di Milano
Department of Mechanical Engineering
Applied Mechanics Group

Proposed MSc thesis topics
(for more information please contact the underlined professor)

ROTORDYNAMICS

1. Development and testing of a new algorithm for the condition monitoring and prognostic of rolling element bearings in a steel plant (Ing. Chatterton)
numerical-experimental thesis
The work consists in developing an innovative algorithm for the diagnostic and prognostic of rolling element bearing. The final product will be a signal processing system, working on fast sampled vibration signals, able to automatically detect and quantify local defects on races and rollers, in order to provide the industry with an effective tool for condition based maintenance. Algorithms should be tested in-field by installing a proper measurement setup on a steel plant.

2. Multiphysic modelling of a rolling element bearing for diagnostic purposes (Ing. Chatterton)
numerical-experimental thesis
The thesis starts with an exhaustive bibliographic research which allows reproducing and refining numerical models proposed in the past, able to simulate the effect of the progressive deterioration of the components. A comparative evaluation of the models will be based on experimental data already collected on specifically designed test-rigs. The second and final part (not requested for short-thesis) will consist of the synthesis of a new model, including elasto-hydrodynamics, able to simulate numerically the signal measured by accelerometers, in order to compare them with experimental data and develop model-based diagnostic techniques.

3. Numerical modelling of a tilting-pad thrust bearing for the energy sector (Ing. Chatterton)
numerical thesis
The objective is the development of a fluid-dynamic model in Matlab and COMSOL multiphysics, for the study of the degradation of performances of thrust bearings for large turbomachineries, based on the "tilting-pad" technology. The model will include the electrical dynamic of the bearing involving electric discharge machining of the surfaces. The effect of the electric discharges on the active surfaces should be coupled with the consequent shaping of the surfaces, affecting the performance of the bearing and the electric dynamics itself. The final product will therefore be able to simulate the electro-thermo-fluid dynamic behavior of the bearing. Already available simplified models and experimental data will be used for validation.

4. Programming of an acquisition and monitoring system for rotating and alternating machineries (Ing. Chatterton)
numerical-experimental thesis
The thesis consists of the programming of an acquisition and monitoring software for rotating and alternating machineries. The software, to be developed in C/C++ and Labview environment, should be able to interface with National Instrument hardware. It will include the traditional acquisition and data management features and innovative capabilities of continuous monitoring. The main focus will be on rotating and alternating machineries, such as: large turbomachineries of the energy

sector, gearmotors for the train and automotive traction, pumps and compressors. The software will be tested in-field in different collaborations with industrial partners.

5. Development of a numerical model for the simulation of planetary gears of wind turbines (Ing. Chatterton)
numerical thesis
The work consists in developing a model for a planetary gear typically installed on wind turbines, able to reproduce the elastic behavior of the components and including the contact of the wheels. The work is composed of a first part of bibliographic research on existing models and a second part of synthesis of a new model in COMSOL multiphysics or Matlab (this part is not requested in case of short-thesis). A final phase of experimental testing could be possible.

6. Control of the vibration of a rotor system equipped with a electromagnetic exciter (Ing. Chatterton)
numerical-experimental thesis
The work consists in developing a model of the entire test-rig composed of a electromagnetic exciter and a rotor supported by oil-film bearing. The first part of the thesis consists in the developing of the model of the exciter including its control loop and the finite beam-element model of the rotor and the foundation. The experimental part of the thesis consist in the setup of the test-rig with some modifications for the installation of the exciter. Any experimental tests are required for the model validation.

7. Integration of sub-structure models defined with different approaches (FEM/modal) (Ing. Chatterton)
numerical thesis
The work consists in developing a methodology for the integration of substructures models of a rotating machine. The substructure models are defined with different methods. Typically the shaft model is developed by means of finite beam-element model and it is connected to the model of the frame defined with a modal approach by means of a 3D FEM commercial software. Starting from the models of the substructures, the goal is the entire model of the system

8. Experimental evaluation of the dynamic coefficients of a tilting-pad journal bearing (Ing. Chatterton)
experimental thesis
The work consists in evaluating the dynamic coefficient and operating properties of a tilting-pad journal bearing by means of experimental tests. The bearing is installed on an instrumented test rig able to measure shaft forces and displacements. The work includes a short practical activity for the installation of the bearing and new components of the rig.

9. Setup of test-rig for tilting-pad thrust bearings (Ing. Chatterton)
numerical-experimental thesis
The work consists in the set-up of a test rig for the experimental characterization of a tilting-pad thrust bearing coated with polymeric material. The preliminary study of the test-rig has been already done. It’s required to perform the preliminary tests and the run-up of the system.