KTH SOLID MECHANICS SEMINAR; Monday, December 18th, 13.15; KTH Solid Mechanics Seminar room

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"Is it possible to analyze rotor dynamics for vertical rotors; a reflection of 15 years in hydropower research"

Hydroelectric power plants supply approximately 20 % of the world's electricity, which is the most important renewable energy in today's industry. In Sweden, the hydropower energy production reaches more than 50 % of the total production in the 21st century. Recently, the energy mix in Sweden has given more importance to the wind power and other types of renewable energies. Hydropower is the main source for regulating variations and maintaining the balance in the grid. The demands of frequent starts and stops might affect the lifetime of mechanical components in the turbine. As a result, it is important for the owner of hydroelectric power plants to identify which upgrades are necessary to increase the life expectancy and reliability of the hydropower units. When calculating the dynamical properties of this type of system, equations are often linearized under several assumptions. In reality, the effects of the nonlinearities can have severe effect on the dynamics of a rotor. As a result, each nonlinear effect has to be studied independently. Another difficulty is that hydropower rotors are normally in vertical position. Therefore the bearing load is unknown which is the main parameter to determine the bearing properties. The bearing load is a combination of mechanical and electromagnetic unbalance, electromagnetic drag due to eccentricities, and to the fluid load in the turbine. The aim of the research has been to determine how all nonlinear effects are affecting the dynamics and how to analyze the dynamics of vertical rotors. To validate developed models severe effort has been put on development of test rigs and measuring techniques on real hydropower units.

Jan-Olov Aidanpää is Chaired Professor in Computer Aided Design at the department of Engineering Sciences and Mathematics, Luleå Univesity of Technology (LTU) since 2013. After his MSc degree in Mechanical Engineering, LTU, 1987 he work with solid mechanics of steam and gas-turbines at ABB STAL AB. After three years at ABB, he initiated PhD studies within chaos of mechanical systems at Solid Mechanics, LTU. He finished his PhD studies 1995 while working at composite institute SICOMP in Piteå. 1998 he returned to Solid Mechanics at LTU as lecturer and initiated his research within rotor-dynamics. He became Professor in Solid Mechanics 2007 due to his research in dynamics.

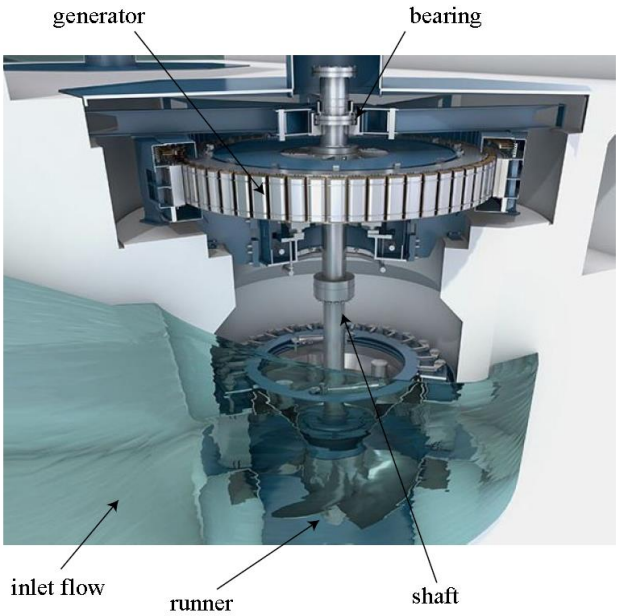

Figure 1. Sketch of the rotating system for a Kaplan rotor