Virtual Commissioning of Large Machines with COMSOL

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Abstract

ABB offers a comprehensive range of reliable and highly efficient motors and generators. All our products are supported with extensive range of services and expertise to save energy and improve customers' processes over the total life cycle and beyond.

One of the ideas behind the professional installation and commissioning services is to get it right from the very start. Thus, the concept of virtual commissioning of large machines and drive lines is attractive both to manufactures and the customers. COMSOL® Server™ provides the platform for creating and deploying applications to back-up commissioning engineers by the expertise of the design team, making the installation process much faster and smoother. However, to appreciate the service the reliable and proven solutions have to be guaranteed. The challenge is then taken to benchmark the COMSOL® solutions, compare against other commercial software simulating rotating components, fluid-film interaction and heat transfer.

Despite well-advanced functions built-in the COMSOL engine, there is the need to integrate dynamics properties of rotating components measured or pre-computed with specialized software. An example is given on how to integrate the fluid-film characteristics derived with ALP3T®. It is advanced and well-proven algorithm, capable of handling cavitation, turbulence, multi-phase lubricants, and variable viscosity. It is then shown how to implement the outcomes of ALP3T® and take full advantage of COMSOL post-processing and graphics to present the results to the customers over the Web deployed applications.

COMSOL rotor-bearing systems are benchmarked for steady-state operations, transients and beyond. Stability thresholds are determined by solving the complex eigenvalues. However, to gain understanding of post-stability behavior, complex, non-linear fluid-film interactions need to be reconstructed from the pre-computed look-up tables.

Final demonstration of the concept of virtual commissioning is given through two industrial applications involving motor-compressor (MC) and turbo-generator (TG). In both cases, the drivelines are representing multi-supported rotor-bearing systems. Thus, there is a strong demand during the installation to account for cold and hot alignments and adjustment of stiffness' of couplings and supports.