Half page Synopsis of Reports for website

Title of Report:　　　CFD-Based Impeller and Seal Rotordynamic Force Coefficients

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Summary:

API 617 level-II analysis requires detailed computed rotordynamic coefficients if level-I criteria fails. Thus, calculating more accurate rotordynamic coefficients is crucial to analyze rotordynamic stability. In the proposed work, a CFD approach is utilized to

   (a) Provide know how for using commercial CFD codes to obtain the stiffness, mass, damping and impedance characteristics of seals and impellers, via detailed user friendly tutorial.
   (b) Provide results of investigative studies to determine the rotordynamic impedances of open impellers at various flow rates in the presence of upstream and downstream components such as volutes, diffusers and rear leakage path.
   (c) Develop a stand-alone (non-commercial TRC) code for rotordynamic response of impellers and seals and leakage rate prediction. This code will automate the procedure for problem setup, solution and post process. The code will allow the user to choose from different turbulence models and wall treatments. Subsequently, a hybrid scheme will be implemented to allow for multi-core/multi-thread parallel computation.

In addition, transient multi-frequency and single-frequency approaches have been developed to extend the CFD predictions to general non-axisymmetric geometries of open face centrifugal pumps and compressors. The new approach has been employed for evaluation of impedances caused by the whirling motion of open face impellers of various specific speeds. Maps of dimensionless dynamic forces versus impeller specific speed at multiple flow rates have been delivered to provide rotordynamic information for a wide spectrum of impeller designs. The approach will be extended to the full four-quadrant operation of impellers under transient modes such as turbining and brake modes. Furthermore, an alternative theoretical impeller model will be coded as a quick alternative to the CFD model. This model allows for low-cost optimization studies and sensitivity analyses.