

## Numerical Vibration Analysis of a High-Pressure Multi-Stage Centrifugal Pump Rotor System

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**Abstract :** In this study, numerical modeling and analysis of the rotor of a high-pressure multistage centrifugal pump were performed. The pump rotor used in the study consists of four impellers, a shaft element, a balance drum, and bearings. First, free vibration analyses of the rotor impellers and shaft were performed separately. Then, the impellers and shaft were assembled, and damped and undamped vibration analyses were performed under different boundary conditions. Static analyses were performed for the rotor system as a whole under appropriate boundary conditions by including the pressure values on the impellers obtained as a result of experimental measurements and the gravity acceleration. By applying variable torque values to the rotor system, the deformation and stress calculations that may occur during sudden stops and starts were made transiently. Again, random vibration analysis was performed by entering different PSD acceleration data into the rotor system, and the changes in the rotor dynamics were analyzed. Within the scope of the study, critical speed analysis was performed by checking whether there was a conflict between the pump operating frequencies and the frequencies of the rotor system and using Campbell diagrams.

**Keywords :** vibration of high-pressure pump rotor, dynamic analysis, numeric analysis, rotor dynamics

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