

Fluctuations of Thermal Load in RCP Impeller

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Abstract

It's known that incomplete mixing of hot and cold water in the sealant gap between the rotating impeller and bush of a main reactor cooling pump causes fluctuation of thermal load in the narrow channel due to the well known Taylor-Couette flow. This phenomenon is caused by different rotating velocity between two adjacent walls and the fluctuations in thermal load leads to thermal fatigue on the impeller surface and results in a RCP failure. However, thermal fatigue was discovered on the impeller surface in the sealant gap between an impeller shaft and bush which rotate at the same speed together with the impeller so that no relative movement exists between the components. It is not uncovered yet in which condition this kind of thermal fatigue occurs. In this numerical study, unsteady boundary conditions at outlet of the impeller are given and the effect of them on the thermal condition inside the RCP impeller is investigated with transient calculations. The results provide with the data of thermal load on the surface of the impeller and bush so that a fatigue analysis can be implemented using this data.