IAF SPACE PROPULSION SYMPOSIUM (C4)
Liquid Propulsion (2) (2)

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ANALYSIS OF PRESSURE FLUCTUATION CHARACTERISTICS OF HIGH SPEED CENTRIFUGAL PUMP

Abstract

Flow state of high speed centrifugal pump affects rotor stability to some extent. During the performance test of a high speed centrifugal pump with a inducer and a half-open centrifugal impeller, abnormal vibration was detected in the bearing position, and the vibration frequency was a multiple of the rotor rotation frequency, which was related to the number of blades of inducer and impeller. In order to reveal the relationship between rotor vibration and unsteady flow in flow passage components , the three-dimensional unsteady turbulence numerical simulation under different operating points was carried out by using the Reynolds time-mean method and the SST K- turbulence model, and the flow field characteristics and the pressure pulsation of the internal characteristic points in the pump were obtained. The results of pressure pulsation spectrum analysis show that the static-dynamic coupling of inducer, impeller and diffuser leads to obvious pressure pulsation in the pump. The peak-to-peak values of pressure pulsation in the impeller region gradually increase from blade inlet to blade outlet. At the same radial position, the pressure pulsation of pressure surface is obviously higher than that of suction surface. The frequency of pressure pulsation in the impeller is 3fr and its multi frequency. The peak-peak value of pressure pulsation at the tongue position in the vane diffuser is the largest. As the current flows downstream, the pressure pulsation in the diffuser decreases gradually. The main frequency of the pressure pulsation in the helical part is 3fr, which is consistent with the passing frequency of the inducer blade. The main frequency of the pressure pulsation in the diffusion section is 7fr, which is consistent with the passing frequency of the long blade of the impeller. All calculated pressure pulsation frequencies are the same as bearing vibration frequencies.