INVESTIGATION INTO UN-INDUCED ECCENTRIC RADIAL MOTION OF A MAGNETICALLY LEVITATED VENTRICLE ASSIST DEVICE

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During initial characterization and testing of a magnetically levitated ventricle assist device, it was observed that the impeller did not maintain a constant position relative to the datum in the housing. The resulting eccentric path, centered on the datum, yields an undesirable impact on the device performance. The pump's impeller is levitated by two electromagnetic bearings which are controlled by feeding back position from an array of Hall Effect sensors. Modifications of the control law to counter the eccentricity showed no improvement in performance, prompting an investigation of the magnetic components. Successive changes in angular orientation of the impeller produce large variations in the control effort required to maintain levitation. These large variations in control effort are attributed to unbalanced magnetic forces, which induce sinusoids in the control effort during normal operating conditions. Once the rotational speed exceeds 4000rpm the unbalanced forces exceed the maximum effort of the electromagnetic bearings, falling short of the designed rotational speed of 6000rpm. The investigation concluded that a magnetic force centering of the entire impeller is required to achieve design constraints.