

GAS FLOW VISUALIZATION ON DRY GAS SEAL WITH VIBRTION

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INTRODUCTION

Dry gas seals are widely used for high speed turbo machinery because of their high sealing performance, low friction and so on. In the dry gas seals, gas leakage can be protected by hydrodynamic gas film generated by high speed rotation. However, if the grooves are damaged by the vibration from the shaft rotation or the impact force from the outside, the function and lifespan of the seal will be drastically reduced. For this reason, as a research focusing on the influence of vibrations in dry gas seals, studies by experiments and analyzes are being conducted. However, there are very few examples that focus on the fact that the flow of the gas film changes under the influence of vibration. Therefore, in this study, a vibration exciter capable of giving arbitrary vibration to test dry gas seal was made and visualization experiment was conducted. In addition, we report velocity distribution by PIV analysis from the visualization results and investigate the relationship between the flow in the clearance due to frequency change and the leakage amount.

VISUALIZATION RESULTS

Figure 1 shows the results obtained by vibrating the test seal at 1 Hz and 3 Hz, subtracting the flow velocity from each other from the result that the seal clearance becomes the maximum and minimum, respectively, and the change in velocity is obtained. Fig. 1 (a-2), (b-2) downward when (a-1), (b-1) are ascending. From the results, the velocity boundary is confirmed in the region between the inner circumference and the outer circumference with all the results of different frequencies and displacement direction of the seal clearance. Also, an outline of the flow direction confirmed in the figure is shown. From the result, in the seal clearance, squeeze flow with the red line as the boundary is shown, and it is confirmed that the squeeze flow moves to the outer peripheral side as the vibration frequency increases. It is thought that the occurrence of the squeeze effect against the leakage amount of the dry gas seal from the leakage amount measurement result and the movement of the boundary promotes the inflow and outflow of the gas outside the clearance and deteriorates the sealing performance. Although the experimental oscillation frequency is low frequency as 1 Hz to 3 Hz, because the seal clearance is set to be large for visualization, if it is converted from the number of squeezes which is often used in dynamic characteristic analysis of the lubricating film. The same wave number corresponds to several hundred Hz. For this reason, the findings obtained the visualizations are useful.

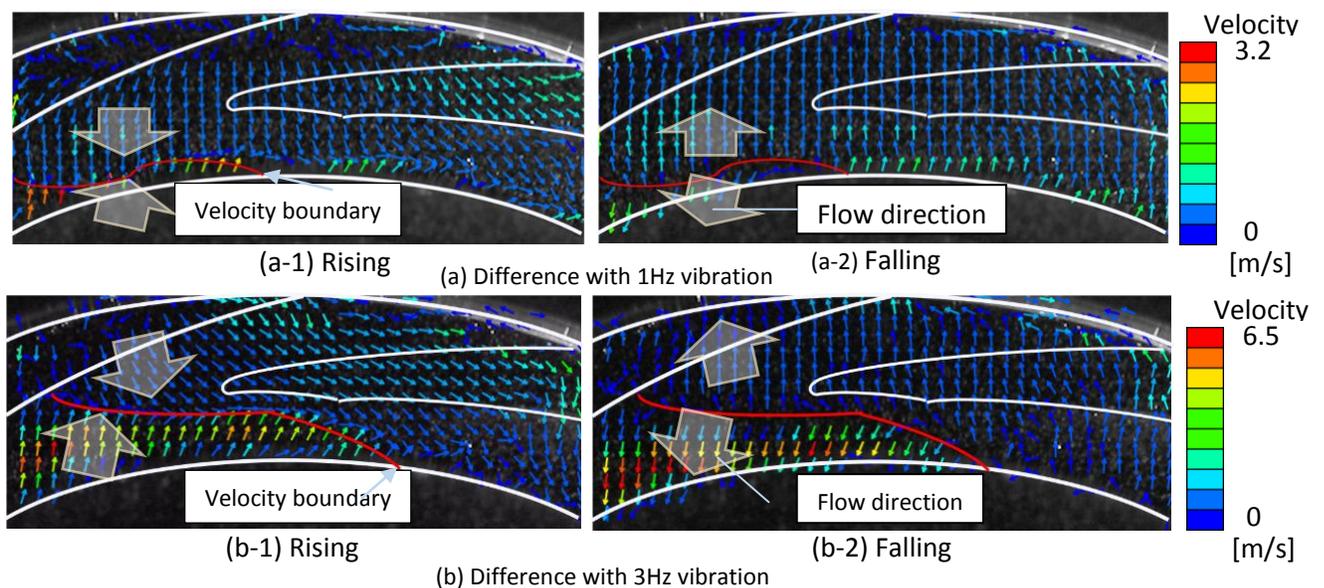


Fig.1 Visualization results under sinusoidal excitation