CHANGES IN CAVITATION AND CONTACT OIL FILM DUE TO INCREASE IN PERIPHERAL VELOCITY IN TRACTION DRIVE UNDER HIGH LOAD

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ABSTRACT
Traction drive is a device that have the transmit power by rolling contact via lubricating oil. Compared to gears, traction drive has the advantage of being low vibration and noise. Therefore, traction drive is expected to be used for speed reducers for robot joint (control) systems and automotive drive systems.

However, cavitation occurs when the gas in the lubricant oil has been precipitated by the negative pressure in the rear of contact part. The cavitation is considered to affect the flow of the rear part of an oil film and it also causes various problems. For example, in the case of planetary type traction drive that has multiple contact parts, there is a risk of overlap with traction contact parts for the cavitation which is formed at the back of certain contact part[1]. It causes direct solid contacts when the cavitation overlaps. It is also conceivable that the rear part of an oil film is ruptured when the cavitation connects with the atmosphere[2]. This phenomenon decreases the amount of re-supply lubricating oil to the traction contact part[3]. Therefore, it is necessity to understand the characteristics of cavitation in the traction drive. However, in previous researches, observation of cavitation is only performed under low load or low peripheral velocity conditions. The changing of cavitation when the operating conditions is approximately the same with practical range has not actually been confirmed.

In this research, two experiments have been carried out under high load and high peripheral velocity operating conditions. The first experiment is measurement of the size of cavitation as the peripheral velocity is increased under the condition of multiple loads. Another experiment is to visualize the oil film rupture under each load condition. Incidentally, in these experiments, the direction of rotation is also changed to observe the changing cavitation. As a results of the experiments, the following was confirmed. Fig.1 shows that the experimental cavitation length with peripheral velocity at each load. In the measurement of the size of cavitation, it was confirmed that the cavitation extend with an increasing in peripheral velocity. However, under the peripheral velocity more than certain peripheral velocity, cavitation began to shrink. In the visualization of oil film rupture, it was confirmed that the atmosphere, which is sucked from the rear part of an oil film, is connect with the cavitation, cause the oil film ruptures even there is an oil film around the cavitation.

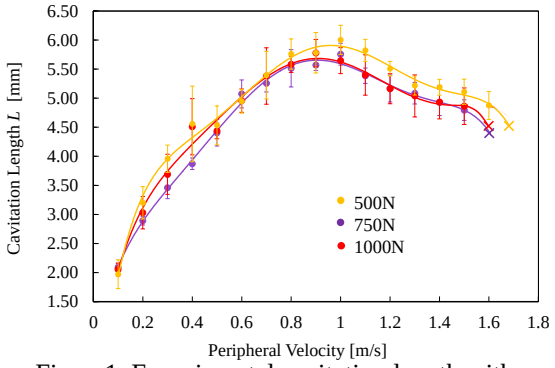

Figure1. Experimental cavitation length with peripheral velocity at each load

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