# Flow Characteristics around a Rotating Circular Cylinder with Arc Grooves

by

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**Abstract**

In this paper, we clarified flow characteristics around a rotating circular cylinder with arc grooves. In this study, thirty-two arc grooves are set on the test cylinder surface, and the pressure of the cylinder surface is measured with the Reynolds number $Re$=0.4×10$^5$~1.8×10$^5$, and rotation of 0~4500 rpm. The drag coefficient $C_D$ and the lift coefficient $C_L$ are calculated from the pressure distribution. In the case of a rotating smooth cylinder, $C_D$ is constant until the spin rate ratio $\alpha$ ($\alpha$=rotating speed/uniform flow velocity) =0.4 and $C_D$ decreases afterwards at $0.4<\alpha<1.0$ in $Re$=1.0×10$^5$. $C_L$ increases as $\alpha$ increases. However, as $\alpha$ further increases, $C_L$ decreases to the minimum value, and $C_L$ increases again with the increase in $\alpha$. As the spin rate ratio $\alpha$ increases, $C_D$ of the circular cylinder with arc grooves increases after it decreases once at $Re$=0.4×10$^5$~0.6×10$^5$. $C_L$ of the circular cylinder with arc grooves increases monotonically with the increase in $\alpha$. These phenomena are due to changes in separation points, and the separation points are clarified from the pressure distribution and flow visualization by the spark tracing method. Moreover, the flow around a rotating circular cylinder with grooves became clear by flow visualization.

***Keywords:*** Rotating circular cylinder, Fluid force, Separation, Spark tracing method

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