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Flow Instability in Channel Flow with a Streamwise-periodic Array of Circular Cylinders[1] KYONGJUN LEE, Inha University, Korea, DONG-HYEOG YOON, Korea Institute of Nuclear Safety, KYUNG-SOO YANG, Inha University, Korea — A parametric study has been carried out to elucidate the characteristics of flow instability in laminar channel flow with a streamwise-periodic array of circular cylinders. This flow configuration is relevant to heat exchanger applications. The presence of cylinders in channel flow causes the attached wall boundary layer to separate, leading to a significant change in flow instability. There exist two kinds of instability; flow undergoes a primary instability (Hopf bifurcation) at a low Reynolds number, and the resulting time-periodic two-dimensional flow subsequently becomes unstable to three-dimensional disturbances at a higher Reynolds number (secondary instability). We report here the dependencies of the primary instability as well as the flow characteristics of the subsequent time-periodic 2D flow, including flow-induced forces and Strouhal number of vortex shedding, on the distance between the cylinders and the channel wall. We also present a Floquet stability analysis on the time-periodic 2D flows to identify the onset of the secondary instability leading to 3D flow.

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