Effect of an Oscillating Cylinder on a Neighbouring Cylinder Wake

Y. Yang\textsuperscript{(1)}, Y. Zhou\textsuperscript{(2)}, Z. Guo\textsuperscript{(3)}

\textsuperscript{(1)} Harbin Institute of Technology, Shenzhen, China
\textsuperscript{(2)} Hong Kong Polytechnic University, Kowloon, Hong Kong
\textsuperscript{(3)} Huazhong University of Science and Technology, Wuhan, China

This work aims to investigate numerically how an oscillating fluid-structure system influences vortex shedding from a neighbouring stationary cylinder. The numerical technique employed is a newly developed lattice Boltzmann method. The calculation was carried out at \( Re = 150 \) for a two-dimensional flow around two side-by-side circular cylinders, one oscillating laterally at an amplitude \( A/d = 0.1 \) and frequency \( f_e/f_o = 0.4 \) \( \sim 1.6 \). The cylinder centre-to-centre spacing \( T/d \) varied from 1.8 to 3.5. The numerical data reconfirm previous experimental finding that the oscillation of one cylinder can lock in vortex shedding from a neighbouring stationary cylinder as well as from the oscillating one. It is further found that the \( f_e/f_o \) range over which the locked-in response is observed grows as \( A/d \) increases. As \( T/d \) increases, this range shrinks at a fixed \( A/d \) because of the fading oscillating influence. Furthermore, the dependence of typical flow structures, drag and lift on \( A/d, f_e/f_o \) and \( T/d \) are also examined.

View the extended summary