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Onset of unsteady flow in wavy walled channels at low Reynolds number[1] TAPAN SHAH, ZACHARY MILLS, ALEXANDER ALEXEEV, Georgia Institute of Technology — Using computational modeling, we examine the development of an unsteady laminar flow of a Newtonian fluid in a channel with sinusoidal walls, driven by a constant pressure gradient. The lattice Boltzmann method was used as our computational model. Our simulations revealed two types of unsteady flows occurring in sinusoidal channels. When the amplitude of the wavy walls is relatively small, vortices forming in the channel furrows are shed downstream. For larger wall wave amplitudes, vortices remain inside the furrows and exhibit periodic oscillations and topological changes. Our simulations establish the optimum wall amplitude and period leading to an unsteady flow at the minimum pressure gradient. The results are important for designing laminar heat/mass exchangers utilizing unsteady flows for enhancing transport processes.

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