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Bifurcations in Flow through a Wavy Walled Channel[1] ZACHARY MILLS, WON SUP SONG, ALEXANDER ALEXEEV, Georgia Institute of Technology — Using computational modeling, we examine the bifurcations that occur in 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 that for a set of geometric parameters the flow in the channel undergoes multiple bifurcations across the range of flow rates investigated. These bifurcations take the form of an initial Hopf bifurcation where the flow transitions from steady to unsteady. The subsequent bifurcations in the flow take the form of additional Hopf, and period-doubling bifurcations. The type and pressure drop at which these bifurcations occur is highly dependent on the geometry of the channel. By performing simulations to determine the critical pressure drops where bifurcations occur and the type for various geometries we developed a flow regime map. The results are important for designing laminar heat/mass exchangers utilizing unsteady flows for enhancing transport processes.

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