FLOWS IN VIBRATING CHANNEL

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ABSTRACT

This study examined the impact of surface vibrations on the propulsion enhancement and the resistance reduction in the movement of parallel plates relative to each other. The research concentrated on monochromatic waves and laminar flows. The vibration wave’s efficiency was evaluated by measuring the external force required to keep one of the plates moving at a fixed speed. It was found that waves moving in the opposite direction to the flow increased resistance, while the response of the flow to waves moving in the same direction as the flow is more complex and depends on the flow Reynolds number. In general, waves must be fast enough to decrease flow resistance, which creates a distinction between slow and fast waves, a helpful categorization for flows with a relatively low Reynolds number. As the Reynolds number increases, the possibility of resonances with the natural flow frequencies becomes a complication. Resonances are not possible with waves that travel faster than the plate speed and these supercritical waves usually decrease flow resistance. Slower (subcritical) waves can lead to more complex flow responses that tend to increase resistance. A complete elimination of resistance is possible if the waves are of a sufficiently short wavelength and travel at high speeds. This suggests that the mechanism has significant potential for the development of propulsion augmentation system.