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Numerical Investigation on Pulsating Heat Pipes with Nitrogen and Hydrogen

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Abstract:
Cryocoolers have been widely used for cooling down the superconductors, cells, cryogenic liquid storage tanks, etc. Since they can only operate vertically, and provide cooling at cold heads, it is difficult to be utilized in distributed cooling and long-distance systems. It can be achieved by a more flexible and high-efficiency heat transfer method connecting cryocoolers and objects. As for that, pulsating heat pipe (PHP) is regarded as a great solution because of its flexible structure and excellent performance. The experiments on PHPs with cryogenic fluids have been carried out, indicating their efficient performances in cryogenics. There are large differences in physical properties between the fluids in room and cryogenic temperature, resulting in their different heat transfer and oscillation characteristics. Up to now, the numerical investigations on cryogenic fluids have not been reported. In this paper, the model of the closed-loop PHP with multiple liquid slugs and vapor plugs is performed with nitrogen and hydrogen as working fluids, respectively. Further, the effects of gravity, surface tension and heating wall temperature on the performance of close-looped PHP with Nitrogen and Hydrogen are also investigated.

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