

Abstract Submitted
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Thermal conductivity measurements using hot-wires at small Peclet number GILAD ARWATZ, YUYANG FAN, MARCUS HULTMARK, Princeton University — The feasibility of using hot-wires to measure gas thermal conductivity is investigated. When the local Peclet number of a hot-wire is small ($Pe \ll 1$), molecular diffusion dominates the heat transport, and the wire becomes less sensitive to velocity. This phenomenon can be utilized to measure the thermal conductivity of the gas. To investigate the viability of the principle of operation, a lumped capacitance model is proposed, capturing the effects of both convection and conduction on heat transfer from the wire. By investigating the sensitivity of the model to velocity, temperature and conduction, it is shown that as wire dimension decreases, the sensor becomes less sensitive to both velocity and temperature and more sensitive to conduction. The model also captures the effect of varying wire dimension as well as overheat ratio.

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