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In-situ shear stress indicator using heated strain gages at the flow boundary CHI-AN YEH, FULING YANG, ME, Natl Taiwan Univ — This work borrows the concept of hot-wire anemometry and sketch a technique that uses local heat transfer to infer the flow field and the corresponding stress. Conventional strain gages were mounted at the flow solid boundary as the heat source and acrylic boundary was chosen for its low thermal conductivity ensuring heat accumulation when a gage is energized. The gage would now work in slightly overheated state and its self-heating leads to an additional thermal strain. When exposed to a flow field, heat is brought away by local forced convection, resulting in deviations in gage signal from that developed in quiescent liquid. We have developed a facility to achieve synchronous gage measurements at different locations on a solid boundary. Three steady flow motions were considered: circular Couette flow, rectilinear uniform flow, and rectilinear oscillating flow. Preliminary tests show the gage reading does respond to the imposed flow through thermal effects and greater deviation was measured in flows of higher shear strain rates. The correlation between the gage signals and the imposed flow field is further examined by theoretical analysis. We also introduced a second solid boundary to the vicinity of the gage in the two rectilinear flows. The gage readings demonstrate rises in its magnitudes indicating wall amplification effect on the local shear strain, agreeing to the drag augmentation by a second solid boundary reported in many multiphase flow literatures.

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