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Measuring near-wall temperatures using dual-tracer fluorescence thermometry and evanescent-wave illumination[1] MYEONGSUB KIM, MINAMI YODA, Georgia Institute of Technology — Fluorescence thermometry measures liquid temperatures based on changes in fluorescence intensity. Dual-tracer (or ratiometric) fluorescence thermometry (DFT) improves the accuracy of FT by taking the ratio of the emissions from two different fluorescent species excited at the same wavelength by the same illumination, thereby removing changes in fluorescence intensity due to spatial variations in the excitation. Moreover, DFT using two species with opposite temperature sensitivities can significantly increase the sensitivity of the technique. The ratio of the signals from an aqueous solution of fluorescein (Fl) and sulforhodamine B (SrB), which have intensities that increase and decrease, respectively, when volumetrically illuminated at 514 nm, varies by as much as 7% per $^\circ$C for fluid temperatures T = 15-60 $^\circ$C. The method has experimental uncertainties, based on temperature calibrations obtained with volume illumination, of $\pm$1.1 $^\circ$C and $\pm$0.3 $^\circ$C at spatial resolutions of 3.7 μm and 30 μm, respectively. This talk describes extending DFT to near-wall temperature measurements by using evanescent-wave illumination to measure fluid temperatures averaged over about the first 0.5 μm next to the wall, or in most cases, the wall surface temperature.

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