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Viscous Drag Measurements using Three Diagnostics[1] JONATHAN NAUGHTON, ERIC DEMILLARD, University of Wyoming, JAMES CRAFTON, JESSICA WEBB, ISSI — The measurement of viscous drag on surfaces is difficult due to the small forces involved compared to the pressure force. In addition, the different diagnostics used for measuring viscous drag often work only under a limited number of conditions. To address this issue, three different approaches for measuring viscous drag were evaluated: oil film interferometry, an integral momentum approach based on velocity profile measurements, and a novel drag balance. Oil film interferometry has been widely used for wall shear stress measurements, but only works on smooth surfaces with the appropriate optical properties. Integral momentum approaches should work on all surfaces, but are limited to two-dimensional flows and require the measurement of detailed velocity profiles. Force balances can also provide measurement on any surface, but are subject to misalignment and pressure gradient errors and provide no information about the flow over the surface. In this study, the three diagnostics were tested over a small region of a plate on which a two-dimensional turbulent boundary layer developed. Measurements were made on both smooth and rough surfaces. The strengths and weaknesses of each of the approaches and the benefits of the combined information they provide are discussed.

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