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Boundary Wall Shear Measurement with an Automated LDV-Based System DARIUS MODARRESS, Measurement Science Enterprise, DAVID JEON, California Institute of Technology, PAVEL SVITEK, Measurement Science Enterprise, MORTEZA GHARIB, California Institute of Technology — Wall shear stress is one of the most important measurements in boundary layer flows. Getting wall shear measurements is generally quite difficult due to the need to measure very close to the wall, where poor optical access, particle seeding, and wall effects can bias the results. To simplify that process, a novel system was developed by Measurement Science Enterprise (MSE). The microPro consists of a 12 mm diameter miniLDV attached to a micro-translation stage assembled inside a sealed housing. The microPro automatically locates the wall and measures the mean flow speed profile from a point as close as 50 microns from the window. Accurate estimate of the mean wall shear is obtained from the calculation of the wall velocity gradient obtained from the velocity profile data. We measured wall shear stress on a boundary layer plate mounted in a water tunnel across a range of Reynolds numbers and compared the results against skin friction coefficient models. We also introduced bubbles into the boundary layer to measure the change in wall shear stress with changing void fraction. The measurements show good agreement with established data. This work is supported by the Office of Naval Research (grant ONR- N00014-11-1-0031) and MSE.

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