Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Dynamic Calibration Technique for the Micro-Pillar Shear-Stress Sensor MPS^3 WOLFGANG SCHRÖDER, SEBASTIAN GROßE, THOMAS SOODT, Institute of Aerodynamics, RWTH Aachen University, Germany — Based on magnetic excitation a dynamic calibration technique for the micro-pillar shear-stress sensor MPS^3, which allows to determine the local wall-shear stress in turbulent flows by optically measuring the velocity gradient within the viscous sublayer of turbulent flows, is described. The proposed dynamic calibration technique allows to assess the micro-pillar dynamic response for different flow media up to approximately 10kHz. The results do convincingly agree with the findings of a second-order analytical approximation based on experimentally determined damped eigenfrequencies and damping coefficients. Measurements for different sensor geometries and in various fluids show the sensor to possess transfer functions ranging from a flat low-pass filtered response to a strong resonant behavior. The results further indicate the pillar to possess a very constant transfer function amplitude at frequencies reasonably below the resonance making it ideal for the measurement of fluctuating wall-shear stress.

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Date submitted: 01 Aug 2008 Electronic form version 1.4