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**Inverse method for the instantaneous measure of wall shear rate magnitude and direction using electrodiffusion probes** MARC-ETIENNE LAMARCHE-GAGNON, JEROME VETEL, Polytechnique Montreal — Several methods can be used when one needs to measure wall shear stress in a fluid flow. Yet, it is known that a precise shear measurement is seldom met, mostly when both time and space resolutions are required. The electrodiffusion method lies on the mass transfer between a redox couple contained in an electrolyte and an electrode flush mounted to a wall. Similarly to the heat transfer measured by a hot wire anemometer, the mass transfer can be related to the fluid's wall shear rate. When coupled with a numerical post-treatment by the so-called *inverse method*, precise instantaneous wall shear rate measurements can be obtained. With further improvements, it has the potential to be effective in highly fluctuating three-dimensional flows. We present developments of the inverse method to two-component shear rate measurements, that is shear magnitude and direction. This is achieved with the use of a three-segment electrodiffusion probe. Validation tests of the inverse method are performed in an oscillating plane Poiseuille flow at moderate pulse frequencies, which also includes reverse flow phases, and in the vicinity of a separation point where the wall shear stress experiences local inversion in a controlled separated flow.

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