

Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

An affordable and accurate conductivity probe for density measurements in stratified flows MARCO CARMINATI, Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, PAOLO LUZZATTO-FEGIZ, Department of Mechanical Engineering, UC Santa Barbara — In stratified flow experiments, conductivity (combined with temperature) is often used to measure density. The probes typically used can provide very fine spatial scales, but can be fragile, expensive to replace, and sensitive to environmental noise. A complementary instrument, comprising a low-cost conductivity probe, would prove valuable in a wide range of applications where resolving extremely small spatial scales is not needed. We propose using micro-USB cables as the actual conductivity sensors. By removing the metallic shield from a micro-B connector, 5 gold-plated microelectrodes are exposed and available for 4-wire measurements. These have a cell constant $\sim 550\text{m}^{-1}$, an intrinsic thermal noise of at most $30\text{pA}/\text{Hz}^{1/2}$, as well as sub-millisecond time response, making them highly suitable for many stratified flow measurements. In addition, we present the design of a custom electronic board (Arduino-based and Matlab-controlled) for simultaneous acquisition from 4 sensors, with resolution (in conductivity, and resulting density) exceeding the performance of typical existing probes. We illustrate the use of our conductivity-measuring system through stratified flow experiments, and describe plans to release simple instructions to construct our complete system for around \$200.

Paolo Luzzatto-Fegiz
UC Santa Barbara

Date submitted: 30 Jul 2015

Electronic form version 1.4