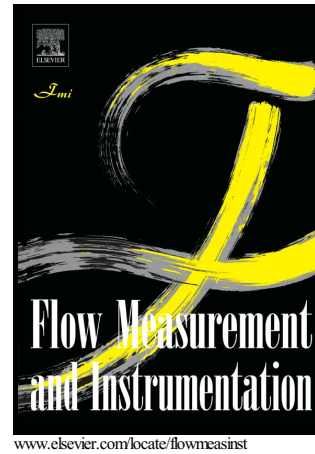


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On the estimation of free-surface turbulence using ultrasonic sensors

G. Zhang⁽¹⁾, D. Valero^(2,*), D. B. Bung⁽³⁾, H. Chanson⁽⁴⁾

⁽¹⁾ Dept. of Hydraulic Engineering, School of Civil Engineering,

University of Queensland, Brisbane, QLD 4072, Australia

⁽²⁾ Hydraulic Engineering Section, *FH Aachen University of Applied Sciences, Bayernallee 9, Aachen 52066, Germany*

Research Group of Hydraulics in Environmental and Civil Engineering (HECE), *University of Liège, Chemin des Chevreuils, 1, building B52/3 floor +1, 4000 Liège, Belgium.*

ORCID: 0000-0002-7127-7547

* Corresponding author. Email: valero@fh-aachen.de

⁽³⁾ Hydraulic Engineering Section, *FH Aachen University of Applied Sciences, Bayernallee 9, Aachen 52066, Germany*

ORCID: 0000-0001-8057-1193

⁽⁴⁾ Dept. of Hydraulic Engineering, School of Civil Engineering,

University of Queensland, Brisbane, QLD 4072, Australia

ORCID: 0000-0002-2016-9650

Abstract

Accurate determination of free-surface dynamics has attracted much research attention during the past decade and has important applications in many environmental and water related areas. In this study, the free-surface dynamics in several turbulent flows commonly found in nature were investigated using a synchronised setup consisting of an ultrasonic sensor and a high-speed video camera. Basic sensor capabilities were examined in dry conditions to allow for a better characterisation of the present sensor model. The ultrasonic sensor was found to adequately reproduce free-surface dynamics up to the second order, especially in two-dimensional scenarios with the most energetic modes in the low frequency range. The sensor frequency response was satisfactory in the sub-20 Hz band, and its signal quality may be further improved by low-pass filtering prior to digitisation. The application of the USS to characterise entrapped air in high-velocity flows is also discussed.

Keywords: acoustic displacement meter, free-surface dynamics, wave, power spectra, air-water flows, stepped spillway

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