

Non-invasive imaging of liquid/gas flow using ultrasonic transmission-mode tomography

Abstract

This paper details the development of non-invasive ultrasonic tomography for imaging liquid and gas flow. Transmission-mode approach has been used for sensing the liquid/gas two-phase flow, which is a kind of strongly inhomogeneous medium. A 16-pair of ultrasonic sensors have been used. By using low excitation voltage of 20 V, fan-shape beam ultrasonic transmitters will emit ultrasonic pulses to the receivers. The investigations were based on the transmission and the reception of ultrasonic sensors that were mounted circularly on the surface of experimental vessel. The algorithms used to reconstruct the concentration profile for two-phase flow using fan-shape beam scanning geometry were presented. By using Hybrid-Binary Reconstruction algorithm (HBR), a real-time of ultrasonic transmission-mode tomography had been developed. Experiments showed that the performance is acceptable with the image reconstruction speed of ten frames per second. The results of the experiments and possible future improvements were also discussed.