

First experiments visualization two-phase high pressure and temperature flows by ultrasonic mesh sensor

Abstract

A novel device for fast visualisation of gas-liquid two-phase flows was developed and tested during loss-off-coolant accident simulations at the thermal hydraulic test facility PSB-VVER, a 1:300 integral model of the VVER-1000. The device is an ultrasonic mesh sensor. It consists of a metallic frame where transmitter and receiver wave-guides are fixed, that form two grids inside the measurement cross section. Ultrasonic pulses are transmitted into the fluid by the 8 wave-guides of the first plane. A second plane of another 8 wave-guides, that cross the ones of the first plane under an angle of 90 deg, serves as receives. The measurement is based on the acoustic conductivity of the two-phase mixture at the locations where the wave-guides cross. The sampling frequency is 250 frames per second. This allows both void fraction measurements and a fast flow visualisation. The sensor is applicable to high pressures and temperatures. All parts and surfaces that are in contact with the fluid are manufactured from stainless steel. During the tests at PSB-VVER the flow pattern in the hot leg of the primary circuit model was visualised for the first time.

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