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Wavy interface behavior and droplet entrainment of annular two-phase flow in rod-bundle geometry with spacers

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Measurements have been conducted to simultaneously consider both liquid films and droplets of the annular flow on a 3X3 simulating BWR (Boiling light water reactor) fuel rod-bundle test-section with spacers as shown in Fig.1. The optical system of a highspeed camera and a tele-microscope was used to record the backlight images at the gap between a corner rod and a side rod of the bundle at high time and space resolutions. The data at high time and space resolutions provided the detailed descriptions of the gas-liquid interface behaviors at the region close to the inlet as well as further downstream. The formation of the "singlet disturbance-crest" near the inlet which is suggested to be the first form of the disturbance wave was observed. An explanation on the mechanism of this formation process was proposed. The data at high time and space resolutions provided the detailed descriptions of the gas-liquid interface behaviors at the region close to the inlet as well as further downstream. The formation of the "singlet disturbance-crest" near the inlet which is suggested to be the first form of the disturbance wave was observed. An explanation on the mechanism of this formation process was proposed. Obtained images of three types of the entrainment process (bag break-up, ligament break-up, and droplet impingement) not only agreed with the previously proposed mechanisms but also included the information about wavy behavior right before and after these events and the created droplets. In addition, the side-view images of the disturbance waves at different stages of development were presented. These data can be used to evaluate other measuring techniques applied to the study of this type of waves. Moreover, a close-up observation at right up- and downstream of the spacer was conducted to describe the interactions between the two-phase flow and this structure. By using these new experimental arrangements, the interaction mechanisms among the wavy liquid film, droplets and spacer are discussed.

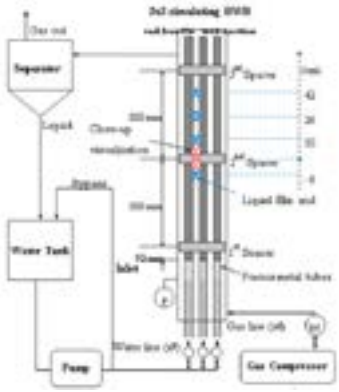

Figure1: *Schematic Diagram of Experimental Apparatus.*

Biography

Tomoaki Kunugi graduated from Keio University in 1977 and got PhD from the University of Tokyo in 1994. He worked at Japan Atomic Energy Institute for 19 years and became a full Professor of Tokai University in 1998, and then became a full Professor of Kyoto University in 2007. He is an international Leading Person in computational multiphase flow and heat transfer technology and is a Specialist in nuclear reactor thermal-hydraulics, safety technology and fusion nuclear technology. He has been developing several RANS, LES & DNS codes for single phase flows and DNS for multiphase flows including phase change phenomena. In addition, He was the first to develop the automatic liquid-crystal thermometry. He has published over 300 archival publications, including monographs and textbooks, journal papers and contributions at international conferences.

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