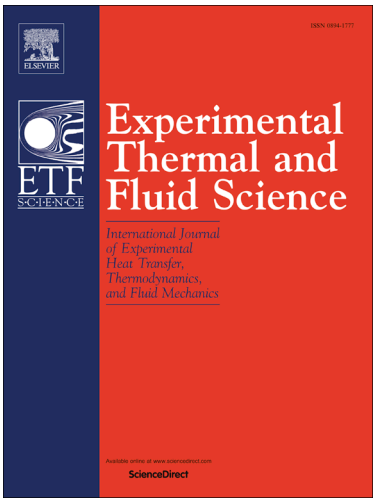

Two-phase slug flow through an upward vertical to horizontal transition

M. Bressani, R.A. Mazza

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TITLE: TWO-PHASE SLUG FLOW THROUGH AN UPWARD VERTICAL TO HORIZONTAL TRANSITION

M. Bressani[1]

R. A. Mazza[1,*]

[1] Mechanical Engineering Faculty, State University of Campinas

* Corresponding author at: UNICAMP/FEM/DE, R. Mendeleyev, 200, CEP: 13083-860 - Campinas, SP, Brazil

E-mail address: mazza@fem.unicamp.br

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Abstract: Although most of the industrial applications of slug flow occur in horizontal, vertical and inclined lines, most of them are subject to the presence of curves and their influence is not really well-known. In a curve, there is the interaction between inertial, gravitational, centrifugal, viscous, pressure and surface forces that can induce complex phenomena such as secondary flow, flooding and phase inversion. This work's objective is to study the effect of a transition in the slug flow parameters such as elongated bubble velocity and lengths, liquid piston lengths and slug frequency. In addition to the quantitative data, high-speed filming and still pictures are used to qualitatively identify the phenomena that occur in the curve. For this purpose, an experimental apparatus consisting of an upward vertical line connected to a horizontal line by a 90° curve with long radius (R/D≈5,5) was constructed. The internal diameter is 26 mm and the working fluids are compressed air and tap water. Measurement stations instrumented with conductance sensors in the vertical line, horizontally and along the transition measure the slug flow parameters. An acrylic curve was also especially constructed for the acquisition of flow images. The tests carried out covered eight different combinations of gas and liquid superficial velocities covering two Fr regimes. The results obtained with the conductance sensors were compared with theoretical and experimental values, obtained at straight inclined pipes with different angles. It was observed that the transition significantly alters the phase arrangement, depending on the superficial velocity of each phase. Despite the change of arrangement along the curve, the main parameters of the slug flow do not suffer a significant influence from the centrifugal field imposed by the curvature. The behavior of these parameters is similar to that of a straight pipes of the same inclination.