Cellular structure in a natural convection loop and its chaotic behaviour. I. Experiment

Osamu Sano

Department of Physics, Faculty of General Education, Tokyo University of Agriculture and Technology, Fuchu, Tokyo 183, Japan

Received 13-NOV-90

An experimental study of a natural convection loop placed in a nearly uniform negative vertical temperature gradient is reported. Distilled water and ethyl alcohol were tested as the working fluid, and two kinds of tori with different tube diameter were used, in order to cover a wide range of Rayleigh numbers as well as to check the one-dimensionality of the flow. The whole flow field was visualized by several standard methods, and was directly measured by means of a laser Doppler anemometer. The critical Rayleigh number, the Rayleigh number dependence of the Reynolds number, and the velocity profile of the quasi-one-dimensional flow along the loop were determined. The three-dimensional cellular structure appears at higher Rayleigh number and shows periodic and nonperiodic change both in space and in time with increase of the Rayleigh number.

Copyright (c) 1998 Elsevier Science B.V. All rights reserved.