The bubble formation experiment as an excitable dynamical system

Viviane S. M. Piassi, A. Tufaile, J. C. Sartorelli

IFUSP

Air bubble formation was studied with a nozzle submerged in a water/glycerol solution [1]. The influence of the pneumatic system was studied using the air flow rate as the control parameter. We have observed period-adding routes and some attractors without external applied perturbation [2]. We have also studied the period-adding bifurcation by a slightly change of the control parameter around the bifurcation values. Changing a tube placed between the control valve and the nozzle, we could study the influence of the tube length on the periodic orbits found as the control parameter change. At this work we present bifurcation diagrams for different tube lengths. Similar behavior was found in different dynamic systems and was already found the evidence of homoclinic behavior in those systems [3,4]. Some similarities between those systems and our experimental results are iso presented by bifurcation diagrams and return maps comparison. References: [1] Tufaile, A., J.C. Sartorelli, Chaotic behavior in bubble formation dynamics, Physica A, 275 (2000) 336. [2] Piassi, V.S.M., Tufaile, A., Sartorelli, J.C., Period-adding bifurcations and chaos in a bubble column, to be published. [3] Pisarchik, A.N., Meucci, R., Arecchi, F.T., Theoretical and experimental study of discrete behavior of Shilnikov chaos in a CO$_2$ laser, Eur. Phys. J. D. 13 (2001) 385. [4] Rajesh, S., Ananthakrishna, G., Relaxation oscillations and negative strain rate sensitivity in the Portevin-Le Chatelier effect, Phys. Rev. E 61, 4 (2000) 3664.