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Transition to chaos in an acoustic stirring cavity flow[1] GABY LAUNAY, TRISTAN CAMBONIE, INSA Lyon, LMFA CNRS UMR 5509, DANIEL HENRY, LMFA CNRS UMR 5509, ALBAN POTHERAT, Coventry University, VALERY BOTTON, INSA Lyon, LMFA CNRS UMR 5509, INSA Euromed, FEZ, Morocco — Acoustic streaming, as a non-intrusive flow generation method, could be a simple and efficient way of including and controlling mixing in liquid phase processes. We are for instance interested in the purification of photovoltaic silicon by directional solidification. This promising process however necessitates efficient mixing of liquid silicium in high temperature furnaces with only poor accessibility to the melt. The fundamental understanding of transition to chaos in this type of flows is a first step towards a thorough mastery of acoustic stirring. Previous experimental measurements of a cavity flow driven by four acoustic streaming jets have shown a complex dynamical transition with increasing acoustic forcing. We propose here to characterize this transition on numerical computations of this same flow by using non-linear dynamics tools. The flow dynamics shows indeed two successive transitions to chaos, separated by a sudden simplification of the dynamics. Both those transitions are characterized using non-linear invariants and are shown to exhibit the classical mechanisms of transition to chaos, namely Hopf bifurcations, period doubling and intermittencies. The sudden intermediate simplification of the dynamics is linked to the breaking of the vertical symmetry.

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