



On nonlinear electronic circuits: some phenomena, experiments and applications

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One of the most interesting aspects of non-linear dynamics is, without a doubt, their universality, implying that very similar emergent behaviours can be observed across rather diverse systems. I will briefly overview my recent research attempting to “summarize” in simple electronic circuits, mainly chaotic oscillators, some phenomena arising in other biological and physical scenarios.

Firstly, a gallery of atypical circuits will be walked through, surveying some oscillators based on transistors, gas-discharge tubes, memristors, nanomechanical devices, including electronic realizations of canonical equation systems. Secondly, elementary networks of these circuits will be considered, demonstrating the spontaneous emergence of patterns such as community structures, remote interdependences, chimera states and paradoxical effects of coupling on synchronization. Thirdly, some applications will be discussed, comprising the replication of neurophysiological hallmarks such as low-frequency amplitude fluctuations, the versatile generation of complex kinematic patterns for an insect-like robot, and distributed sensing using wireless-coupled oscillators. While by no means a comprehensive introduction to this rapidly developing, multidisciplinary field, this presentation should hopefully provide some insight into the current ideas and challenges of this area.