CHAOS IN COUPLED HETEROCLINIC CYCLES AND ITS PIECEWISE-CONSTANT REPRESENTATION

Arkady Pikovsky [a] and Alexander Nepomnyashchy [b]

Abstract. We consider two stable heteroclinic cycles rotating in opposite directions, coupled via diffusive terms. A complete synchronization in this system is impossible, and numerical exploration shows that chaos is abundant at low coupling levels. With the increase of coupling strength, several symmetry-changing transitions are observed, and finally, a stable periodic orbit appears via an inverse period-doubling cascade. To reveal the behavior at extremely small couplings, a piecewise-constant model for the dynamics is suggested. Within this model we construct a Poincaré map for a chaotic state numerically, it appears to be an expanding non-invertable circle map thus confirming the abundance of chaos in the small coupling limit. We also show that within the piecewise-constant description, there is a set of periodic solutions with different phase shifts between subsystems, due to dead zones in the coupling.

[a] University of Potsdam, Potsdam, Germany.
[b] Technion - Israel Institute of Technology, Haifa, Israel.