

Kinematics, dynamics and complex motion in biology

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We present a study on complex motion in biology. From a descriptive point of view, we have kinematics. Introducing the causes of movement or an interaction with the environment we have a dynamical point of view. Our main objective is the classification of complex patterns of motion.

We consider a two-parameter family of bimodal interval maps which determines the displacements through iteration. A trajectory is, therefore, composed of patches of linear motions, intertwined by changes of direction.

The characterization of the types of movements is obtained from the topological classification of the interval map family. Techniques from symbolic dynamics and topological Markov chains are used, and the main classifying tool is the kneading invariant - the symbolic itinerary of the critical orbits of the interval maps.

We present part of a catalogue or dictionary of typical trajectories.

We further discuss ongoing work on multiple organism motion with interactions and dependence on the environment.