

Reduction of Multidimensional Flow to Low Dimensional Map for Piecewise Smooth System Experiencing Chaos

Ekaterina E. Pavlovskaja, Marian Wiercigroch

Centre for Applied Dynamics Research School of Engineering and Physical Sciences, University of Aberdeen, Aberdeen, UK

We consider dynamics of the piecewise smooth nonlinear systems for which general methodology of reducing multidimensional flows to low dimensional maps is proposed. This includes creation of the global map by stitching together local maps, which are constructed in the smooth sub-regions of phase space. Full details are given for a case study of drifting impact oscillator where five-dimensional flow is reduced to one dimensional (1D) approximate map. An appropriate co-ordinate transformation allowed the drift to be de-coupled from the bounded system oscillations. For these oscillations an exact two-dimensional map has been formulated and analysed. A further reduction to 1D approximate map is possible and will be discussed in the lecture. A standard nonlinear dynamic analysis reveals a complex behaviour ranging from periodic oscillations to chaos, and co-existence of multiple attractors. Accuracy of the constructed maps by comparing the dynamics responses with the exact solutions for a wide range of system parameters will be examined.

[View the extended summary](#)