An Environment for Computing Topological Entropy for Skew-Product Transformations

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Abstract. The main objective of this paper is to introduce a specific software package for computing topological entropy of two-dimensional skew-product transformations. The Kneading Theory establishes the necessary background for this study is some particular cases. This is not only a hard but also a computationally expensive problem. The CAS *Mathematica* provides a suitable environment for implementing the algorithm associated to the rigorous computation of the topological entropy of the considered systems.

Keywords: Symbolic Mathematical Computing, Kneading Theory, Skew-products Maps, Topological Entropy, Dynamical Systems, *Mathematica*.
Topics: Computational Sciences.

Nonlinear dynamic systems models are ubiquitous throughout the sciences and engineering. Efficient computational analysis of specific dynamical systems is often a critical component for the successful completion of a research or design project.

We live in a dynamical world. For many reasons, we want to understand these dynamics: to predict the weather, to prevent heart attacks and limit spread of infections diseases, to control agricultural pests, to farsee the consequences on man´s activities on the global climate and the impact of climate changes that might result from these activities, to design both more reliable and more efficient machines, and so on.

Questions about how processes evolve and change in time are really important and of broad usefulness.

Indeed in various domains of science many situations can be, at least approximately, modelled in a very simple way via difference equations of the form

$$x_{n+1} = f(x_n), \quad n = 0, 1, 2, \ldots$$

where f is a particular function which define a dynamical system. The notion of dynamical system is the mathematical formalization of the more general concept of a deterministic process. The future state of many Physical, Chemical,