Approximate symmetries of differential equations and Numerical Jet Geometry

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Abstract

There has been considerable progress in the theory and implementation of symbolic computation algorithms to automatically determine and exploit exact symmetries of exact differential equations. In many applications however, the differential equations describing a model are not exact but instead approximate. For example they may contain parameters that are only known approximately. Existing symbolic programs are unstable if applied to such problems directly, and indirect techniques (e.g. replacing approximate parameters by symbolic ones) are not practical in the case where there are many parameters.

A first generation of symbolic-numeric methods is described. Topology preseving continuation methods determining generic points on the jet components of differential systems and random slicing of the components are key tools. They allow the determination of approximate symmetries in a region of interest. Examples of classifying the symmetries arising in Kamke's test set of ODE will be given. This is part of the new area of Numerical Jet Geometry.