UNICAMP – IMECC
Departamento de Matemática

Seminário de Sistemas Dinâmicos e Estocásticos

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Título: Algebraic geometric classification of the singular flow in the contrast problem in nuclear magnetic resonance

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Resumo. The problem of maximizing the contrast in Nuclear Magnetic Resonance spectroscopy is an important issue in Medicine. It depends on the biological matter (blood, cerebral matter, water...) the device is focussed on. Too low a contrast must be enhanced by providing contrast accelerators to the patient, with toxicity issues. The aim of the project is to give mathematical methods to get the optimal contrast just by controlling the spectroscope.

We present a model consisting of two coupled vector fields controlled by magnetization parameters, and we address the contrast problem to the question of the classification of quadrics in four dimension. Standard algorithms of Effective Algebraic Geometry are used, although special improvements permit to bypass the intrinsic high level of complexity of the formal computations. Knowing precisely the underlying geometry of the problem is the first step in constructing effective control strategies. We discuss our results in four real cases corresponding to the most challenging biological interfaces.

This is a joint work with Bernard Bonnard (Dijon, France), Monique Chyba and John Mariott (Hawaii, USA).

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