Julius-Maximilians-
UNIVERSITÄT
WÜRZBURG

Institut für
MATHEMATIK

Mathematisches Kolloquium

Am **Mittwoch**, den **17.06.2009**, **17:00 Uhr** findet im Seminarraum HS4 der folgende Vortrag statt:

Prof. Dr. Christopher I. Byrnes

Giovanni-Prodi-Gastprofessor

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zum Thema

New Topological Methods in Nonlinear Oscillations

Abstract: Periodic phenomena are pervasive in nature and in engineered systems. They are exhibited, for example, in idealized models of the solar system and in observed circadian rhythms that regulate basic biological functions. Electronic devices producing stable periodic signals underlie the electrification of the world and wireless communications. In this talk, we present conditions that guarantee that a periodic motion exists for a dynamical system. We will begin by analyzing a stable oscillating circuit that is in widespread commercial use in electronic communications, e.g., in every cell phone. This simple example shares some important features with a nonlinear three-dimensional model of an AC motor that uses oscillations in its magnetic field to produce stable mechanical rotations. These features can be expressed very simply in terms of the vector field defining the dynamics, an *angular variable* - a concept with roots in earlier work of G. D. Birkhoff and the topology of the sublevel sets of Liapunov functions. These are global constructs and allow one to use global topological methods, for example the fruitful combination of homotopy and cobordism, to understand the existence of periodic phenomena. In fact, using these methods in higher dimensions and the proofs of Poincare Conjecture in dimensions three and four, we prove the existence of an invariant solid torus and an angular variable are necessary for the existence of an asymptotically stable periodic orbit. Conversely, periodic orbits exist for any vector field on an n-dimensional solid torus having an angular variable. This sufficient condition is itself a corollary of a Main Theorem, which is valid for a broad class of n-dimensional compact manifolds (with or without boundary). In closing, we illustrate the Main Theorem in the case of 3-dimensional manifolds.

Ab 16:30 gibt es Kaffee im Sitzungsraum S106. Alle Interessenten sind herzlich eingeladen.

gez. Die Dozenten der Fakultät