STEVENS Institute of Technology

Arthur E. Imperatore School of Sciences and Arts

Department of Mathematical Sciences

Seminar in Nonlinear Systems

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Rational Maps and Sierpinski Gaskets

Tuesday, May 4, 2004
4:00 pm
Pierce 116

Abstract: Sometimes the terms "fractal" and "Julia set" are used in a undistinguished manner to describe certain sets that arise from iterative methods in dynamical systems or topology. This is not always correct. Consider the Sierpinski gasket, which is a classical example of a fractal set (broadly speaking, is a self-similar set with a fractal dimension). Many are the methods to produce such set, some of them are topological in nature (as the iterative process of removing open middle equilateral triangles) and some are more dynamical (e.g. the "chaos game"). On the other hand, the Julia set of a map can be defined to be the closure of the set of points that under iteration exhibit an unpredictable behavior. For example, the Julia set of the map $z \to z^2$ is no other than the unit circle, since all other points either map toward infinity or toward the zero under iteration of the quadratic map. Clearly, the circle is a set of dimension one.

Then, not all Julia sets are fractals and not all fractals arise as Julia sets of some map. Well, not quite.

In this talk we present two families of rational maps of degree three and four acting on the Riemann sphere. We will show that the Julia sets for many elements of these families are generalized Sierpinski gaskets and that one, and only one element in the degree three family has a Julia set homeomorphic to the Sierpinski gasket.

This talk is based on the paper *Rational Maps with Generalized Sierpinski Gasket Julia Sets*, written by R. L. Devaney, M. Moreno Rocha and S. Siegmund, 2004.

Refreshments at 3:50pm

For additional information contact Marco Lenci (201-216-5453) or Patrick Miller (201-216-5452).