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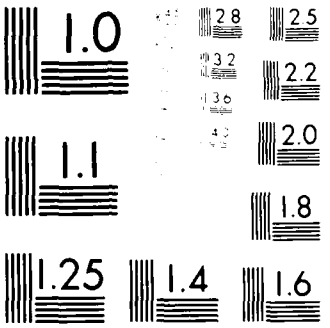

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The PI reports that two students received their Ph.D's while supported by this grant. Also six papers were published.

The PI and his co-workers looked at the problems arising in the area of nonlinear vibrations. Essentially equations such as that for a periodically forced, damped pendulum are capable of exhibiting behavior which was unsuspected even 10 years ago and this PI was in the forefront of the effort to explain these mysteries. It was he who coined the term 'chaos' and the students and publications here identified are confined to that topic.

Dr. Yorke reports on work to determine the factual dimension of attracting sets for differential equations together with some vigorous results on the dependence of such sets on equation parameters.

This is extremely good work.

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FINAL SCIENTIFIC REPORT
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January 25, 1987

The last progress report was submitted in January, 1986. This report includes papers completed since then and also reports on lectures by Yorke in the '85-'86 academic year.

The central question of the previous proposal is restated in the title of our new preprint:

L. Tedeschini and J. A. Yorke:

How often do simple dynamical processes have infinitely many coexisting sinks? Comm. Math. Phys., in press.

Newhouse had shown that the set of such dynamical processes is large in the the sense of Baire category. We chose what appears to be a generic example and show that the set of parameters described by Newhouse has measure zero. L. Tedeschini was supported in part under this grant and received her Ph. D. in applied math in June, 1986.

Another student supported under this grant, Eric Kostelich, completed his Ph.D. degree in Applied Mathematics in December 1985. Part of his thesis is included in revised form in the paper:

Eric Kostelich and J. A. Yorke:

Lorenz cross sections of the chaotic attractor of the double rotor, Physica D, in press.

That paper addresses the question of how to take cross sections of a high dimensional attractor. In the emphasized example the attractor has dimension about 3.5 AFTER taking the Poincare cross section. It is shown in the paper how one can choose a plane and

intersect it with the attractor, reducing the cross section to dimension about 1.5. It is possible to take this cross section because the system has two positive Lyapunov exponents. Thus each point of the attractor lies on a two dimensional unstable manifold. The procedure is to find where a plane intersects these leaves. The intersection in this case in a single point locally.

The following paper is a major simplification of previous work, based on topological degree.

K. T. Alligood and J. A. Yorke:

Why period doubling cascades occur: periodic orbit creation followed by stability shedding.

The following paper puts into rigorous form some ideas we had been talking about non rigorously for the past two years, ideas that were difficult to make precise.

K. T. Alligood, L. Tedeschini, and J. A. Yorke:

Metamorphoses: sudden jumps in basin boundaries, submitted to Comm. Math. Phys.

This proposal is based heavily on the following papers which are typed drafts which will soon be submitted for publication.

H. Nusse and J. A. Yorke:

Is every approximate trajectory of some process near an exact trajectory of some nearby process?

E. Coven, I. Kan, and J. A. Yorke:

Pseudo-Orbit shadowing in the family of tent maps.

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