SIGGRAPH 1990

*17th International Conference
On Computer Graphics and
Interactive Techniques*

*Dallas Convention Center
August 6th—10th*

COURSE NOTES

15

FRACTALS: ANALYSIS AND MODELING

Chair
Dietmar Saupe
Universitat Bremen

Lecturers
Heinz-Otto Peitgen
Universitat Bremen
Przemyslaw Prusinkiewicz
University of Regina
Deitmar Saupe
Universitat Bremen

Fractals - Analysis and Modeling

SIGGRAPH 1990, Dallas

Abstract of Course

The course covers basic principles and applications of fractals, supported by video animations and live demonstrations. Its goal is to present the theoretical foundations of fractals from the computer graphics point of view, their algorithmic generation and their uses in modeling, including many new state-of-the-art algorithms. Topics include:

Random fractals
Fractal dimension, statistical vs. exact self-similarity, fractional Brownian motion, representations in the spectral and time-domain, construction by random successive additions, lacunarity, recent development of a new algorithm for multi-variable fractals allowing variation of dimension and crossover scale, stochastic noise synthesis.

Dynamical systems and fractals
Fast algorithms for Mandelbrot and Julia sets and their 3D-rendering, relation between fractals and chaos, and iterated function systems with applications in image compression.

Modeling
L-systems and biologically based modeling, developmental plant models with animation, solid textures via fractal perturbations, application of multi-variable fractals for animation of e.g. clouds, fractal interpolation of data bases for synthesis of realistic detail.

Speaker Biographies

Dietmar Saupe (Course chair). *1954 in Bremen, Germany. Dr. rer. nat. in Mathematics, 1982 at the University of Bremen. Visiting Assistant Professor of Mathematics at the University of California, Santa Cruz, 1985-87 and since 1987 Assistant Professor of Mathematics at the University of Bremen. There he is a researcher at the Dynamical Systems Graphics Laboratory with main interests in mathematical computer graphics and experimental mathematics. He has been involved in several past SIGGRAPH courses on fractals, as the course chair in 1988 and 89 and as the coauthor/coeditor of "The Science of Fractal Images," 1988, and "Fractals for the Classroom," 1990, both from Springer-Verlag. He is one of the contributors to the exhibit "Frontiers of Chaos" which is being shown worldwide under the auspices of the Goethe-Institute. Dr. Saupe is a member of the ACM and SIGGRAPH.

Heinz-Otto Peitgen. *1945 in Bruch, Germany. Dr. rer. nat. in Mathematics 1973, Habilition 1976, both from the University of Bonn. 1977, Professor of Mathematics at the University of Bremen and since 1985 also at the University of California, Santa Cruz. Research in nonlinear analysis and dynamical systems. He has been a lecturer at the last five SIGGRAPH courses on fractals. He is coauthor (coeditor) of the books "The Beauty of Fractals," 1986, from which the exhibit "Frontiers of Chaos" of the Goethe-Institute evolved, of "The Science of Fractal Images," 1988, and of "Fractals for the Classroom," 1990, all from Springer-Verlag. Dr. Peitgen is a member of the AMS.

Przemyslaw Prusinkiewicz. Dr. Prusinkiewicz is Associate Professor of Computer Science at the University of Regina, Canada, where he is leading the Computer Graphics Group. Born and raised in Poland, he received his M. Sc. and Ph. D. degrees, both from the Technical University of Warsaw, Poland, in 1974 and 1978. Before moving to Canada in 1982, he was Assistant Professor of Mathematics at the University of Science and Technology in Algiers. In 1988 he was Visiting Assistant Professor of Mathematics and Computer Science at the Yale University. The focus of his research is in the area of fractals and the modeling of plants. He is author (with coauthor Aristid Lindenmayer) of the book "The Algorithmic Beauty of Plants" (Springer-Verlag, 1990). Dr. Prusinkiewicz is a member of the ACM, SIGGRAPH, and the IEEE Computer Society.

Schedule of Course[1]

Fractals - Analysis and Modeling
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Opening .... 8.00 a.m.

1. Introduction to Random Fractals .... 8.10 a.m.
    D. Saupe

2. Iterated Function Systems .... 9.30 a.m.
    H.-O. Peitgen

3. L-Systems and Fractals I .... 11.00 a.m.
    P. Prusinkiewicz

Lunch break .... 12.00 a.m.

4. Fractals: An Animated Discussion (film) .... 1.00 p.m.
    H.-O. Peitgen, H. Jürgens, D. Saupe, C. Zahlten

5. Deterministic Fractals .... 2.00 p.m.
    H.-O. Peitgen

6. Random Fractals in Higher Dimensions .... 3.00 p.m.
    D. Saupe

7. L-Systems and Fractals II .... 4.00 p.m.
    P. Prusinkiewicz

Summary and Closing .... 5.00 p.m.

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[1]Times are only approximate and may change according to break schedule and other circumstances.

Contents of Course Notes