

From Subdivision to Wavelets and Fractals

Overview

The course introduces practical tools and theoretical aspects of state-of-the-art methods for the approximation of univariate and bivariate functions. The applications of these tools appear in computer aided geometric design (CAGD), in computer graphics, in automobile industries, in image compression, in computational geometry and in data analysis. Subdivision schemes are efficient computational methods for the design and representation of 3D surfaces of arbitrary topology. They are also a tool for the generation of refinable functions, which are instrumental in the construction of wavelets, and are the key for developing algorithms for multiresolution analysis. This course presents various flavours of subdivision, concerned with geometric modeling, wavelets and fractals. Our starting point is the general setting of scalar stationary schemes on regular grids. We also briefly review other classes of schemes, such as schemes on general nets. Different representations of subdivision schemes, and several tools for the analysis of convergence, smoothness and approximation order are discussed, followed by explanatory examples. Finally, we present the latest development on shape preserving fractal functions and constructions of different types of fractal surfaces, and applications of fractal shapes in biomedical applications and CAGD.

The participants will be able to practically apply the methods during the course. Moreover, the course will give the students deep understanding of the theory behind the computer algorithms, and a good background to those students who will choose to do a research work in subdivision and wavelets, and explore the proximity of these areas with fractals.

Dates for the Course	4th December, 2017 to 11th December, 2017
Host Institute	IIT Madras
No. of Credits	1
Maximum No. of Participants	40
You Should Attend if you are	<ul style="list-style-type: none"> ▪ A mathematician interested in CAGD, Wavelets and Approximation Theory ▪ An engineering 3rd/4th year student interested to learn subdivision schemes in CAGD ▪ A student or scientist/faculty from an academic institution interested in subdivision schemes and wavelets. ▪ Working at industry with specialized areas like CAD, CAE, CAGD, computer graphics, Image-signal processing work, curves and surfaces design.
Course Registration Fees	<p>The participation fees for taking the course is as follows: Student Participants: Rs. 1000 Faculty Participants: Rs 2000 Government Research Organization Participants: Rs. 3000 Industry Participants: Rs.3000</p> <p>The above fee is towards participation in the course, the course material, computer use for tutorials and assignments, and laboratory equipment usage charges. Mode of payment: Demand draft in favour of "Registrar, IIT Madras" payable at Chennai. The demand draft is to be sent to one of the Course Coordinator at the address given below.</p>
Accommodation	<p>The participants may be provided with hostel accommodation, depending on availability, on payment basis. Request for hostel accommodation may be submitted through the link: http://hosteldine.iitm.ac.in/iitmhostel/</p>

Course Faculty



David Levin received a Bachelor of Science in Mathematics and Geophysics, and a Ph.D. in Geophysics from the Tel Aviv University, Israel. After post doctoral position at Brunel University, England, Levin worked at Israel Aircraft Industry. Since 1977 he is with the School of Mathematical Sciences, Tel Aviv University, Israel. His areas of expertise are Subdivision for Curves and Surfaces, Wavelets, Computer Aided Geometric Design, Manifold Approximation, Rational Approximation, Radial Basis Functions and Numerical Analysis. He is an internationally recognized leader in subdivision schemes, convergence acceleration and numerical integration. His work on butterfly and Hermite-interpolatory subdivision schemes are highly cited. He has published more than 80 peer-reviewed articles and technical reports. He has been the invited speaker at several national and international conferences and workshops. He is currently working as Professor Emeritus, School of Mathematical Sciences, Tel Aviv University.

<http://www.math.tau.ac.il/~levin/>



Dr. Arya Kumar Bedabrata Chand is an Associate Professor of Indian Institute of Technology, Madras. His research interests are Fractal Functions, Fractal Approximation, Wavelets and Computer Aided Geometric Design. He works on theory and applications of smooth or non-smooth fractal interpolation functions. Recently, his research group has introduced shape preserving fractal splines/surfaces in the literature.

<https://mat.iitm.ac.in/People.html>



Dr. Saravana Kumar G is an Associate Professor of Department of Engineering Design, Indian Institute of Technology, Madras. His research aims at development of representational and computational tools for virtual and physical prototyping applied to arrive at solutions to design problems. Some of the specific research areas include CAD and 3D data acquisition technologies: geometrical modelling schemes, X-ray tomography, photogrammetry and image-based modelling systems; Rapid prototyping: advances in rapid prototyping technologies; Bio- inspired routes: fractal geometry, soft computing tools like neural networks, genetic algorithms for various inverse design and optimization problems.

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Course Coordinators

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