WPI HAROLD J GAY LECTURE SERIES

PDEs and Fractals • Geometry with its applications has been at the heart of the development of partial differential equations and boundary value problems since the very beginning. In physics, biology, economics, and other applied fields, a variety of new problems are now emerging that display unusual geometrical, analytical and scaling features, possibly of fractal type. The objective of these lectures is to acquire the view of outstanding mathematicians on the subject of differential equations and fractals, and their developments and applications, in a broad perspective encompassing both classical highlights and contemporary trends.

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Asymptotic coupling of models of different dimensions: MAPDD

Friday, April 6, 2018
4:00pm, Atwater Kent Labs 116

The lecture is devoted to the problem of coupling of models of different dimension. Many real-world problems are related to solving partial differential equations in domains of complex geometry, combining multiple thin parts with massive parts: the set of blood vessels, structures in aircraft and spacecraft, industrial installations, pipelines with reservoirs. The direct numerical computations with standard codes are impossible because such complex geometry needs a very fine mesh "feeling" all elements of the structure and so the 3D computations need too much time-memory resources. That is why the dimension reduction is a very popular trend in reducing computational cost; however, the completely reduced models lose very important local information and are not precise. For example, in the blood circulation modeling one-dimensional models are widely applied but the description of the clot formation and blood flow near a stent needs 3D local zoom. How to glue the models of different dimension? The lecture presents an asymptotic approach to this problem, based on asymptotic analysis of partial differential equations in domains containing thin parts and connected sets of thin cylinders. For example the Navier-Stokes equations are used in hemodynamic modeling. We present the method of partial asymptotic decomposition of domains (MAPDD) giving a high precision coupling of models of different dimension.

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Refreshments available before the lecture • Participation of faculty and students is most welcome

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Poster Organization: Rhonda Podell