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zve všechny zájemce

na přednášku

Bridging Scales - Challenges to Mathematics and Computational Sciences

kterou prosloví

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for Scientific Computing (IWR)**

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ve 14.00 hod.

ve velké posluchárně
Matematického ústavu AV ČR,
Žitná 25, Praha 1.



Jde o sedmou přednášku konanou
v rámci cyklu reprezentačních přednášek
organizovaných na počest

prof. Eduarda Čecha,

jednoho z nejvýznamnějších českých
matematiků novodobé historie
a zakladatele
Matematického ústavu AV ČR.

Pavel Krejčí, ředitel

Bridging Scales - Challenges to Mathematics and Computational Sciences

Mathematical modelling and computing in sciences and technology are confronted with complexity, high dimensionality, nonlinearities, uncertainty and multiple scales, challenges demanding new mathematical theory and methods. This lecture will focus on the goal, the mathematical concepts and methods building bridges across the disparate scales of space, time and organization, from microstructures to macroscopic systems. Due to the rapid progress in experimental and computational technologies in the last decade a huge amount of information on all scales could be made available waiting to be processed and analyzed using mathematical modelling and simulation.

Mathematical models have to be adjusted to the scales using varying mathematical concepts and techniques. Especially on the nano- and micro-scale, e.g. in molecular and cellular biology or in nanophysics of materials and fluids, discrete and stochastic description of processes are getting more and more important. Since, finally the dynamics and the properties of macroscopic systems have to be understood, controlled or even designed, the models on different scales have to be linked and the information produced on the various levels has to be transferred. E.g. questions like the following are arising: What is the influence of a mutation in genes in muscle cells on the rhythm of the heart, of changes of the crystal structure to the mechanical properties of a material.

Finding transmission conditions in a computable way is an important goal for mathematics and computational sciences. Analytic and computational bridging of scales have to be coupled, taking also into account new hardware offering multi-scale and parallel structures.

In this lecture several examples mainly from life sciences and reactive flow in porous media will be presented, the mathematical and computational concepts and methods developed so far for handling the scale bridging will be discussed. Finally open important problems for mathematical research will be formulated.