# Institute Lecture

## Physiological Modeling in Computational Hemodynamics

**Prof. Marek Behr**
**RWTH Aachen, Germany**

**Monday, 5th November 2012, Time: 5.00 PM, Venue: L-16, Lecture Hall Complex**

### Abstract

Modeling and computational analysis play an increasingly important role in bioengineering, particularly in the design of implantable ventricular assist devices (VAD) and other blood-handling devices. Numerical simulation of blood flow and associated physiological phenomena has the potential to shorten the design cycle and give the designers important insights into causes of blood damage and suboptimal performance.

A set of modeling techniques based on stabilized space-time finite element formulation of the Navier-Stokes equations will be presented. Specific issues affecting shape optimization in this setting, such as parametrization of complex 3D surfaces and sensitivity to constitutive model selection, will be discussed.

In order to obtain quantitative hemolysis prediction, cumulative tensor-based measures of strain experienced by individual blood cells must be developed; red blood cells under shear can be modeled as deforming droplets, and their deformation tracked along pathlines of the computed flow field. An alternative continuum-based approach is also under investigation.

Another aspect of blood pump performance is related to platelet aggregation and thrombus formation. A three-species model for platelet aggregation is being developed based on a set of physiological experiments in collaboration with the Aachen University Clinic.

### About the speaker

Professor Marek Behr received his PhD from University of Minnesota in Aerospace Engineering and Mechanics in 1992. Then he was at the Army High Performance Computing Research Center, Minneapolis; Department of Mechanical Engineering and Materials Science, University of Houston, and at TU Munich. He joined RWTH Aachen in 2004 as the Chair for the Computer Analysis of Technical Systems (CATS). He is also an adjunct professor at Rice University and serves as the President of the German Research School for Simulation Sciences and the Scientific Director for the Aachen Institute for Advanced Study in Computational Engineering Science. Prof. Behr is on the editorial board of several journals. His areas of interest include High Performance Computing, Finite Element Analysis, Optimization, Modeling Moving Boundaries and Interfaces, Complex Fluids and Hemodynamics.

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**Tea at 4.45 PM** **All interested are welcome.**

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