ETH zürich

Distinguished Lecture Series

of the Department of Mechanical and Process Engineering

Cut-Cell Method Based Analysis of Freely Moving Particles in Viscous Flows

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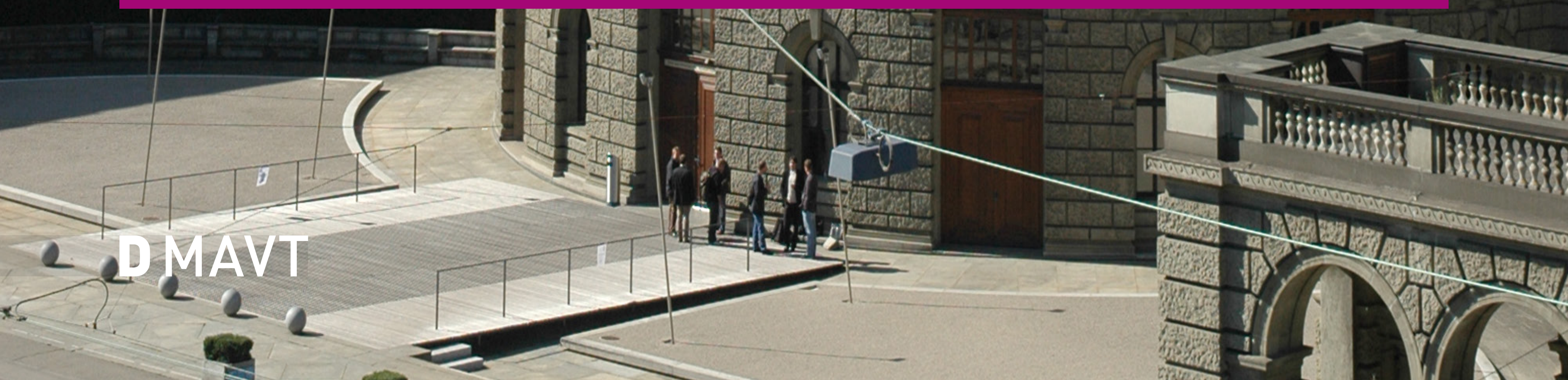
7 March 2016 from 5:15 p.m. in HG F 30 (aperitif after the lecture)

A Cartesian cut-cell method for viscous flows interacting with freely moving boundaries will be presented. The method provides a sharp resolution of the embedded boundaries and strictly conserves mass, momentum, and energy. A new explicit Runge-Kutta scheme is introduced which significantly reduces the computational time for tracking moving boundaries and subsequently reinitializing the solver without lowering stability or accuracy.

The structural motion is computed by an implicit scheme with high stability due to an iterative strong-coupling strategy. A new formulation for the treatment of small cut cells is presented with high accuracy and robustness for arbitrary geometries based on a weighted Taylor-series approach solved via singular-value decomposition. Unphysical oscillations occurring in Cartesian grid methods applied to moving-boundary problems are eliminated.

The efficiency and the accuracy of the new method are demonstrated for several three-dimensional cases of laminar and turbulent particulate flow such as a spherical particle settling in a quiescent fluid, rotation of an ellipsoidal particle in simple shear flow, and a cloud of particles in homogeneous turbulence.



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