modynamics applications through providing a library of the common performance-critical algorithms.

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MS92

VexCL: Vector Expression Template Library for OpenCL

VexCL is modern C++ library created for ease of OpenCL developement. VexCL strives to reduce amount of boilerplate code needed to develop OpenCL applications. The library provides convenient and intuitive notation for vector arithmetic, reduction, and sparse matrix-vector multiplication. Multi-device and even multi-platform computations are supported. This talk is a brief introduction to VexCL interface.

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MS92

Developing Numerical Algorithms on Heterogeneous Architectures with High Productivity in Mind

Porting existing or developing new scientific applications on today's heterogeneous architectures can be a very challenging and time-consuming process. The necessity of abstracting the underlying hardware from the numerical developers becomes a crucial approach to effectively use the available processing units. This separation of concerns further allows the mathematician and the computer scientist to respectively concentrate on what they are good at. This talk will describe how some of the linear algebra community are tackling complex GPU-based systems when it comes to implementing high performance numerical libraries.

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MS92

ViennaCL: GPU-accelerated Linear Algebra at the Convenience of the C++ Boost Libraries

In order to provide simple access to the vast computing resources in graphics processing units (GPUs) for general purpose scientific computing, the open source linear algebra library ViennaCL is presented. ViennaCL is written in C++ and used like existing CPU-based linear algebra libraries, thus it can be integrated into existing code easily. Moreover, the generic implementations of algorithms such as iterative solvers allow for code reuse beyond device and library boundaries.

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MS93

A Multi-Scale Model for Capillary Driven Contact-Line Dynamics

We present a multi-scale method to simulate the flow of two immiscible incompressible fluids in contact with solids. The macro model is a level set method. The contact line is tracked explicitly and moves according to a slip velocity that depends on the wall contact angle of the interface with the solid. The relation between wall contact angle and slip velocity is determined in a micro model based on the phase field method. The phase field method seeks for an equilibrium slip velocity in a box around the contact point, prescribed a static contact angle at the solid and the wall contact angle in the far field. The dimensions of the box are chosen such that physical diffusion processes around the contact point are fully represented. We present numerical results for capillary-driven flows which demonstrate the convergence of results in the macro model and compare the behavior with other approaches in contact line dynamics.

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MS93

A Model for Simulating the Wrinkling and Buckling Dynamics of a Multicomponent Vesicle

Abstract not available at time of publication.

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MS93

High-resolution Solver for the Poisson-Nernst-Planck Equations and its Applications

In this talk we present a high-resolution finite-volume method for solving the Poisson-Nernst-Planck equations on adaptive grids and for complicated geometries. We will highlight the importance of local charge conservation, at the coarse-fine grid interface, on the overall accuracy of the solver. Next, we utilize the solver to study the charging dynamics of super-capacitors at high voltages where nonlinear effects can lead to new charging mechanism previously unknown. Finally we will discuss possible future directions.

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