

Ultrascale Simulations of Non-smooth Granular Dynamics

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ABSTRACT

This talk presents new algorithms for massively parallel granular dynamics on distributed memory architectures using a domain partitioning approach. Collisions are modeled with hard contacts in order to hide their micro-dynamics and thus to extend the time and length scales that can be simulated. The multi-contact problem is solved using a non-linear block Gauss-Seidel method that is conforming to the subdomain structure. The parallel algorithms employ a sophisticated protocol between processors that delegate algorithmic tasks such as contact treatment and position integration uniquely and robustly to the processors. Communication overhead is minimized through aggressive message aggregation, leading to excellent strong and weak scaling. The robustness and scalability is assessed on two very large supercomputers with up to 458752 processor cores. The simulations can reach an unprecedented resolution of up to ten billion (10^{10}) non-spherical particles and contacts.

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