Some recent progress on variational time integrators

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RESUMO

In this talk I will present a very brief overview of recent progress on variational time integration. This theory enables the construction of time integrators for conservative mechanical systems retaining many of the geometric features the exact systems has. The key idea behind the theory is to first construct a discrete approximation to the action functional of the system, and then obtain the time-integration algorithm from a discrete version of Hamilton's principle. This stands in contrast to the more traditional approach of discretizing the equations of motion directly. All variational time integrators are symplectic, they display outstanding long-time behavior and energy conservation even for moderately large time steps, and there is a discrete version of Noether's theorem that provides a clear pathway to the exact conservation of, for example, linear and angular momenta.

In particular, I will introduce a class of variational time integrators that are fully asynchronous, i.e., allow for the independent choice of time steps in each element of a finite element mesh. I will discuss their parallelization, stability, and an extension to handle contact constraints. Numerical examples in solids and simple fluid-solid interaction problems will be presented.

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