Energy-consistent Galerkin-based time integration: A comparison using a finite linear viscoelastic rope.

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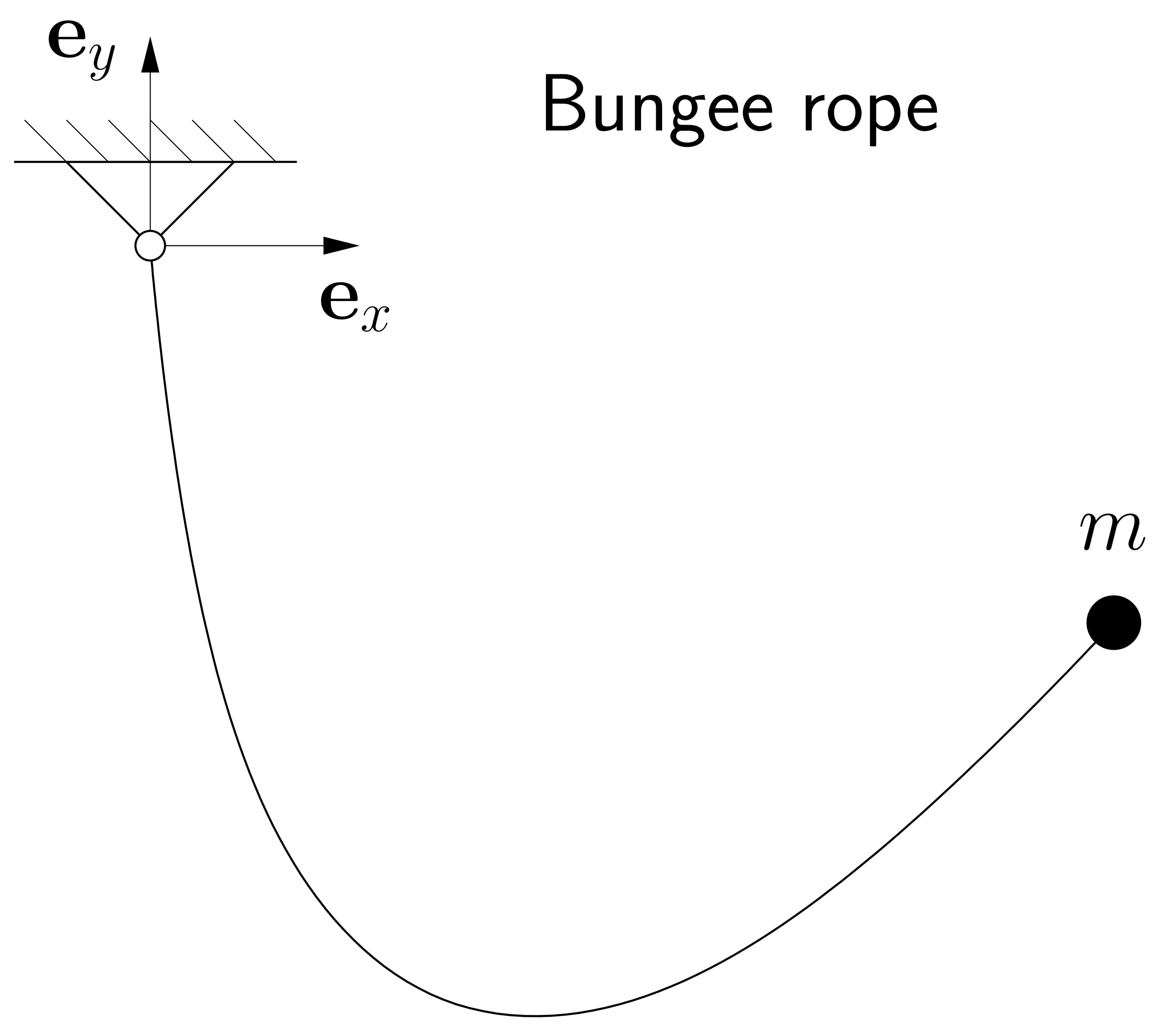

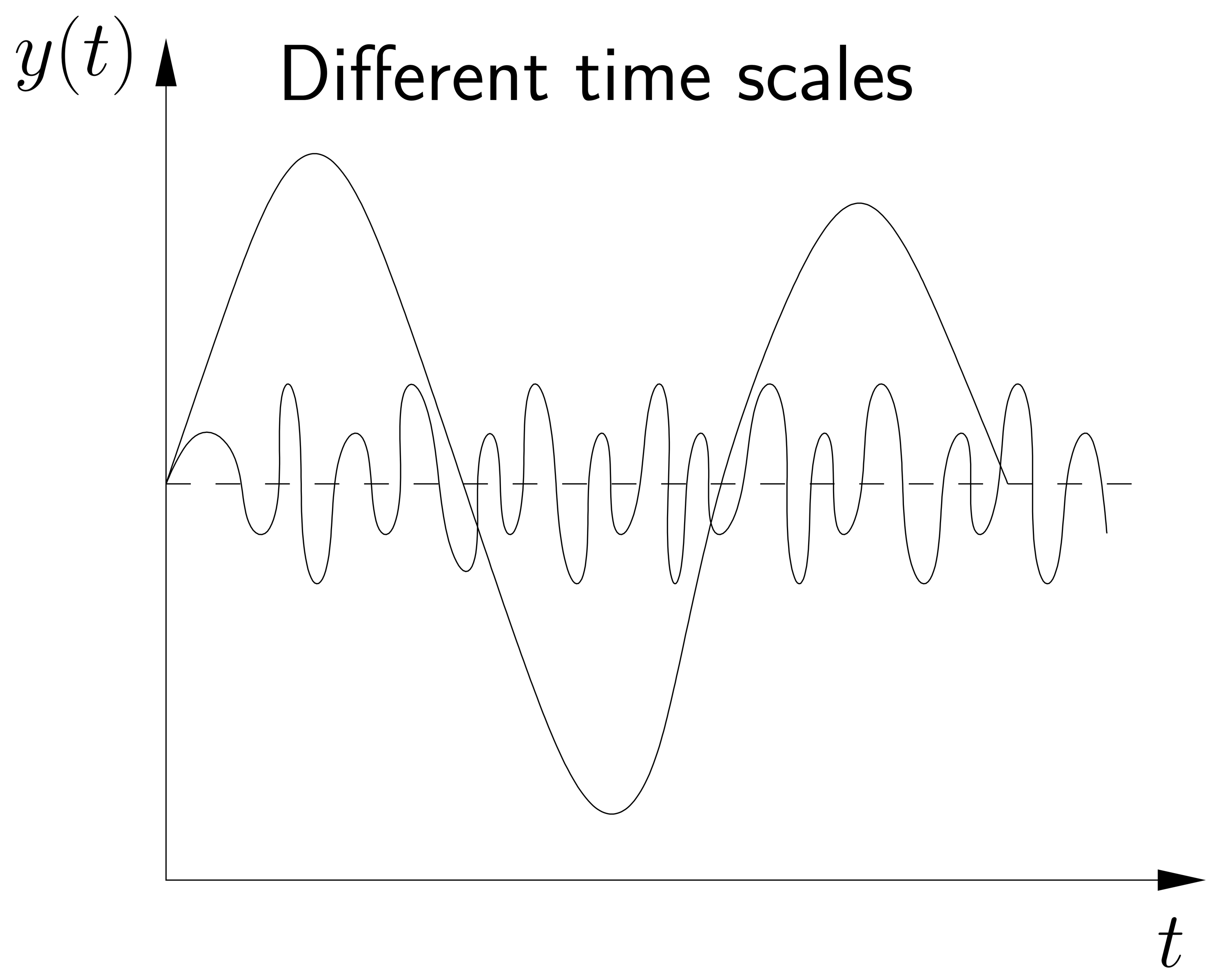

Presently, there is a significant effort to find more robust and reliable time integration methods for dynamics. One possible way of designing such methods is the *structure-preserving* time integration. The goal here is to design a method, which ensures that physical features of the underlying problem are inherited by the discrete solution. Structure-preserving methods have already proven their excellent robustness as well as their reliability of finding meaningful solutions of different problems. However, the ability to take into account the usely present different time scales in different sub-solutions has hitherto based on a fractional step method. Using this method, the problem is solved sequentially on so-called micro time steps. An alternative way is to use a Galerkin-based method, solving the problem simultaneously on all micro time steps.

In preparation for an energy-consistent Galerkin-based multi-scale time integration, an energy-consistent Galerkin-based method for problems on different time scales should be implemented. The considered dynamical system is a rope consisting of a finite linear viscoelastic material (a bungee rope). The energy consistent incorporation of the damping energy should be derived and demonstrated with appropriate numerical examples. The numerical examples should include different boundary conditions, and should show the necessity of energy consistent modifications despite of a higher order accurate quadrature.

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