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Different faces of stiffness

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The words “stiff”, “stiffness”, “stiffening”, etc., arise often in applications when simulating, calibrating and controlling dynamics. But these words often have different meanings in different contexts. A subset on which we will concentrate includes: (1) decaying numerical ODE stiffness; (2) highly oscillatory stiffness; (3) stiffness matrix; and (4) numerical stiffening.
Some of these terms are popular in scientific computing, while others come from mechanical engineering. A potential confusion may arise in this way, and it gets serious when more than one meaning is encountered in the context of one application. Such is the case with the simulation of deformable objects in visual computing, where all of the above appear in one way or another under one roof.

In this talk I will describe the various meanings of stiffness, how they arise in the above context and how they are related, what practical challenges they bring up, and how these challenges are handled. The concepts and their evolution will be demonstrated. It is about meshes, their resolution and spectral properties.

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