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**A comparison of a rigid body mode deflation method and
AMG for simulation of 3D mechanics**

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In many real life engineering problems the analysis of mechanical systems by simulation plays an important role. Moreover, studying the behavior of these mechanical systems is important as they are often coupled to other physical phenomena, an example is geomechanics and fluid flow in reservoir engineering. Simulation of mechanical problems involves modeling of materials with non-linear material properties like hyper elasticity, plasticity and viscosity. These non-linear equations are often solved by the Newton-Raphson method which involves solving one linear system per Newton-Raphson iteration. Solving the linear systems dominates the total runtime of the simulation and hence has to be fast. For realistic three dimensional mechanical problems that are defined on meshes with a large number of elements and that involve different materials, the resulting stiffness matrix is often sparse and ill conditioned. We need powerful preconditioners to solve these linear systems with iterative solution methods. In this talk we compare the performance of two preconditioners for the conjugate gradient method: the deflation method based on the elimination of the rigid body modes and Smoothed Aggregation Algebraic Multigrid (SA AMG). We show and discuss the results for matrices from two different real life applications, structural mechanics and geomechanics.