Scalable solution of the Linear Elasticity Equations in 3D

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Approximation of the solution for a large sparse system of linear equations in computational terms can require commensurate High Performance Computing (HPC) resources. This is needed due to the complexity in handling several iterations and the overhead of managing variables during the computation. A number of studies were done to improve and understand the convergence of a range of linear elastic material deflection problems. Preconditioning methods and a variety of Krylov Subspace preconditioned (KSP) types are found to be helpful to solve them. One critical factor while simulating physics phenomena relies in increasing the Degrees of Freedom (DoF), to correspond with an increase in the physical size of a system, or the density of elements required to resolve stress gradients. This study combines both concepts, the preconditioner and KSP to solve the unstructured mesh finite element problem for the finite strain linear elastic stress problem. A comparison is done by benchmarking the performance of the KSP versus preconditioners. The target is to reduce the amount of HPC computational resources needed to solve, minimising memory and time spent to solve.