



Newton Solver Stabilization for Stokes Solvers in Geodynamic Problems

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The most commonly used method by the geodynamical community for solving non-linear equations is the Picard fixed-point iteration. However, the Newton method has recently gained interest within this community because it formally leads to quadratic convergence close to the solution as compared to the global linear convergence of the Picard iteration. In mantle dynamics, a blend of pressure and strain-rate dependent visco-plastic rheologies is often used. While for power-law rheologies the Jacobian is guaranteed to be Symmetric Positive Definite (SPD), for more complex (compressible) rheologies, the Jacobian may become non-SPD. Here we present a new method for efficiently enforce the Jacobian to be SPD, necessary for our current highly efficient Stokes solvers, with a minimum loss in convergence rate. Furthermore, we show results for both incompressible and compressible models.