

## **Nonlinear Preconditioning for the Parallel Solution of Systems Algebraic Equations**

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A common pitfall in large, complex simulations is a failure of convergence in the nonlinear solver, typically Newton's method or partial linearization with Picard's method. We present a framework for nonlinear preconditioning, based upon the composition of nonlinear solvers. We can define both left and right variants of the preconditioning operation, in analogy to the linear case. Although these composite algorithms are demonstrably effective (as we will show with several examples), we currently lack a convincing convergence theory, making this a perfect proving ground for numerical and symbolic experimentation.