Matrix Computations and Scientific Computing Seminar

Organizer: J. Demmel and M. Gu

Wednesday, 12:00–1:00 pm, 380 Soda Hall

Nov 2 **Keith Miller**, UC Berkeley (retired)

Moving Finite Elements, Preconditioners for Nonlinear Krylov

Gradient-Weighted Moving Finite Elements is especially suited to PDE problems with sharp moving fronts. It treats the solution as an evolving manifold and discretizes with an evolving piecewise linear manifold. I'll outline the variational and mechanical interpretations of this moving node method and present graphics of applications to the shallow water equations, mean curvature, Stefan problem for melting ice, nonlinear arsenic diffusion. Neil Carlson and I in our work on GWMFE introduced a nonlinear Krylov accelerator for the modified Newton method for the implicit equations of our stiff ODE solver. NKA has been robust and efficient on all our GWMFE 2D and 3D codes since 1990. Our GWMFE codes have mostly preconditioned NKA with the saved LU inversion of an old Jacobian. This simple NKA routine has also been robust and efficient on a great variety of other medium and large scale applications, with various more rough or physics-based preconditioners. I'll concentrate on the need for robust memory-efficient preconditioners for NKA . I'll discuss the "augmented basis" method of Xaba's 1997 thesis and some of Carlson's more recent large scale applications - to the dominant eigenmode of neutron population in a nuclear reactor, to casting codes for turbine blades, with various rough preconditioners.