NIMROD Basic Algorithm Development (4/02)

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for the NIMROD Team

Present status:

- Web-available Version 3_0_2 (http://nimrodteam.org) has general Lagrange-type elements but no continuity evolution.
- Repository is now at SAIC, and Scott Kruger is the NIMROD librarian.
- Changes for Version 3_1 are being coordinated: pressure evolution is separated into number density and temperature equations, pre-, and post-processing changes.

New developments:

- Vacuum region allows much more realism in D3D studies—example simulation now shows 2/1 growing faster than 1/1, as in the experiment.
- Nonlinear vacuum evolution—local temperature-dependent resistivity is working better than marker concentration/level set approach.
- Resistive wall—Tom Gianakon coupled NIMROD boundary conditions to Morrell Chance's VACUUM code. Testing is in progress.
- Algorithmic changes for improved behavior with flow have been worked out but not implemented yet.
- Nonsymmetric matrices--Coupling with AZTEC (& PETSc) will allow new formulations. They will be used for improving 2-fluid algorithm.

Linear Solver Development for NIMROD (4/02)

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- Motivation
  - Improve NIMROD's efficiency through non-native software
  - Add capability for solving non-symmetric/non-Hermitian systems (2-fluid, implicit advection, other possibilities)
- Funding: Sandia contract to UW out of OFES funds sent there 1-2 years ago for NIMROD support
- Progress
  - Plimpton's coupling between NIMROD Version 2_3_* and AZTEC has been updated for Version 3_*.
    - new array index ordering
    - so far only grid vertex nodes (poly_degree=1)
    - uses Mike Heroux's wrapper for complex systems
  - Benchmarking tests
    - Both use point-block Jacobi preconditioned CG
    - 2-norm residuals match iteration-by-iteration
  - Timing test with Jacobi (not fastest)
    - AZTEC is 2-3 times faster on IBM SP3 than NIMROD native (96x96 bilinear, 16 processors, ET linear case)
    - Very different than comparison for Version 2_3_* on T3E (See Steve's APS 99 poster, http://nimrodteam.org)
- Future work
  - Couple side and interior nodes for higher-order elements
  - Examine other preconditioning options
  - Same exercise with PETSc and compare packages
  - Test on nonsymmetric/non-Hermitian systems