

NIMROD Regression Testing

**NIMROD pre-Sherwood Meeting
May 1, 2009**

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Motivation for regression testing

- **Make sure code capabilities do not regress;**
 - I.e., test to make sure the code doesn't break
- **Regression testing usually means *automated* regression testing**
 - Nightly regression testing is usually the standard
 - Catch bugs quickly
- **Standardized tests also makes it easier to negotiate among developers**
 - Your coding better not break my coding
- **Helps new users and developers understand how the code works**

NIMROD Testing uses the txttest system

- Downloadable systems for generic software exists
 - None deals with issues of scientific codes; esp. numerical precision
- txttest used for many scientific codes
 - VORPAL
 - UEDGE
 - FACETS
 - FMCFM (including GYRO)
 - ...
- Test system is a mixture of autotools and shell scripts
 - At the heart is the “diff”
 - Currently regular diff and h5diff
 - Only major diff not supported is ncdiff (netcdf)
 - H5diff and ncdiff have options for diffing based on precision

Txtest system has 3 levels

- **Scripts useful for running the individual test components:**
runsafely.sh, testdiff.sh, ...
- **Autotool facilities for run entire test system:**
make check, make check-ser, ...
 - Autotools used because of discovery mechanism, easy directory recursion, etc.
- **Scripts for automating the nightly tests:**
getproj.sh, buildproj.sh, cron.sh, ...
- **Txtest has setup for automated mailing, logging, etc.**
- **Documentation (preliminary) at:**
 - <http://ice.txcorp.com/trac/txtest>

How do you design a test?

- **Want a test to run quickly**
 - The faster it runs, the more likely you are to use it
 - This generally means the test is an under-resolved case
 - NIMROD tests:
 - Coarse mesh
 - Only 3 time steps
- **Problem with approach:**
 - In only 3 time steps, physical changes to fields are small
 - Bugs will show up as round-off errors
 - Sorting out what's real and what's numerical is harder than long time simulations

See “Adventures in Merging” thread

gabrielle 447: h5diff -p1.e-16 linornl00001.h5

1009 differences found

gabrielle 448: h5diff -p1.e-14 linornl00001.h5

132 differences found

gabrielle 449: h5diff -p1.e-7 linornl00001.h5

80 differences found

gabrielle 450: h5diff -p1.e-4 linornl00001.h5

37 differences found

gabrielle 451: h5diff -p1.e-3 linornl00001.h5

8 differences found

gabrielle 452: h5diff -p1.e-2 linornl00001.h5

3 differences found

gabrielle 453: h5diff -p1.e-1 linornl00001.h5

2 differences found

What's currently in nimtests

- **slab (gaussian)**
 - Simple slab tearing mode based on Parker-Barnes case
- **jcp (zeroBeta)**
 - Zero-beta, cylindrical (r-z grid) tearing mode based on JCP paper
- **gmode (gmode)**
 - Slab geometry gmode case (Schnack-developed Roberts-Taylor case)
- **ornl (multiple tests)**
 - Cylindrical tearing mode case from ORNL papers (Holmes)
 - Has beta so several permutations of this case
- **kink (linMhdKink)**
 - Inverse equilibria, toroidal kink mode used in NIMROD-M3D-NOVA-K benchmark (no particles)
- **elm01**
 - Direct equilibria case from 2005 milestone
 - Wanting to make this a parallel test case but still under development

What should be added

From Dalton's email on V&V in NIMROD:

- **1) Cylindrical resistive tearing from JCP paper**
- **2) Slab two-fluid comparison with Ahedo/Ramos**
- **3) Linear ballooning comparison with ELITE**
- **4) Nonlinear ballooning through intermediate phase**
- **5) Linear particle kink/fishbone**
- **6) GEM reconnection**
- **7) Rutherford evolution**
- **8) CDXU**
- **9) High-beta disruption**
- **10) Other???**

Status of nimdevel

- **Merge with nimuw-r629 is finished in a branch**
- **Some minor issues with Eric's commits that need to be resolved**
- **Need to test two-fluid, but haven't set it up yet.**