Propose Standards for Verification Test Problems

• **Note distinction between:**
  – **Verification test problems** – A particular problem with known solution,
  – **Verification tests** – Usage of one such test problem to verify a particular code.

• Ideally, would have only exact, analytic test problem solutions,
  – But, these are rare & only test limited set of code capabilities,
  – ⇒ will also need semi-analytic or simulated results,
  – Latter, should be “reference” results, e.g.,
    • Arrived at by more fundamental technique,
    • Of very high accuracy,
    • Or have been confirmed by independent codes.
Objectives of Standards for Verification Test Problems

- Identify physics and/or algorithm tested,
- Establish relevance,
- Provide assessment of confidence in accuracy of result by categorizing type of solution,
  - Range from strong confidence (exact, analytic solutions),
  - To weak (numerical solutions from single code).
- Ensure adequate documentation,
- Set guidelines for input & output formatting ⇒ test problems easy to use.
Strawman Format Inspired by NTCC

Modules Description

Keyword

Value

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•
•

⇒ store in database

Can include links to objects or additional information

Name
GLF23
TargetEnvironment
DEC, SGI, SUN, IBM, HP, Linux (LF, Portland, NAG)
Version
1.61
VersionDate
03/13/2003
Webpage
http://w3.pppl.gov/NTCC/GLF
Contact
Jon Kinsey
Review Information
NTCC Review of GLF23 Model
Repository
Tar Archive for the GLF23 module
Zip Archive for GLF23 module
ForUpdatesSubscribeTo
glf23-request@pppl.gov
Strawman Format for Test Problems

1. Summary

This section consists of keyword-value pairs that briefly characterize the test problem & could be stored in a database or used to construct an index.

- Type of code tested
- Specific physics / algorithm tested
- Dimensionality & temporal variation
- Type of solution (one of):
  1. Analytic solutions
  2. Semi-analytic solutions
  3. Manufactured solution
  4. Simulation result confirmed by one or more independent codes
  5. Simulation result from one code
- Relevance
2. Detailed Description

- **Equation(s) solved**
- **Specifics (may vary with problem)**
  - Geometry
  - Volumetric quantities (e.g., plasma parameters)
  - Boundary conditions
  - Sources & sinks
- **Description of solution method (one of):**
  - Derivation of analytic solution,
  - Derivation of semi-analytic solution and description of technique used to arrive at final result,
  - Derivation of manufactured solution,
  - Description of or reference to code used to compute simulated result & details pertaining to that run.
3. Model Results

- Include data needed as input to the code that’s going to be verified,
  - & the model solution that will be used for comparison with that code.
  - Non-analytic solutions should also have error estimates for output data.
- Establishing widely acceptable & effective format a priori is difficult,
  - ⇒ Will examine format(s) used in initial set of test problems for insight into possible standards.
- Possibilities:
  - Plots (1-D, 2-D, 3-D),
  - Tabular text (suitable for use with commercial packages),
  - Self-describing, device independent formats (netCDF, HDF),
  - MDS+,
  - Else?