RELAP5 Merged Code Features

Glen Mortensen, Dan Prelewicz, ISL

Rich Riemke, Gary Johnsen, INL

Idaho National Laboratory

ISL

RELAP5/MOD3.3 Added Features

- **IAPWS 1995 Steam Tables**
  - Bi-quintic fit of Gibbs Function in Pressure-Temperature Plane
  - Separate, Overlapping Tables for Liquid, Vapor, and Supercritical Pressure Regions
  - Transport Properties, Viscosity, Thermal Conductivity, Surface Tension
  - Density and Temperature Derivatives wrt Pressure and Internal Energy
- **PARCS 3-D Kinetics Coupling using PVM**
- **Noncondensable Improvements**
  - No more Partial Backups

Idaho National Laboratory

ISL

RELAP5/MOD3.3 Added Features

- **CANDU Models**
  - Moody Critical Flow
  - KAERI Wall Vaporization
  - CANDU Pressurizer Changes
  - CANDU Channel Component
  - Digital Control Component
  - Relaxation of Wall Mass Transfer
  - Baker-Just Metal-water Reaction Equations
- **Offtake Model Improvements**
  - Variable Angle Offtake
  - Offtake Volume Checking

Idaho National Laboratory

ISL

RELAP5/MOD3.3 Added Features

- **Radiation Model Improvements**
  - Restarts Corrected
  - Wall-to-Steam Radiation
- **Metal-Water Reaction Improvements**
  - Can Input Flag for Hydrogen Addition to Noncondensables in Volume
  - Can Input the Metal-Water Reaction Model Constants
- **Mixed Convection Heat Transfer**
  - Swanson-Catton
- **Mass Error Improvements**
  - TYP1200 mass error is less than 100 kg

Idaho National Laboratory

ISL

RELAP5/MOD3.3 Added Features

- **Over-Condensation Fixes**
  - Reduced number of failures from over-condensation
- **Godunov Boron Error Correction**
- **Configure Installation Script**
  - Two command install - "configure" and "make"
- **Little Endian Fixes**
  - Runs Correctly on Intel Computers (Windows and Linux)
- **Time Step Control Changes**
  - Maximum Void Fraction Change
  - Maximum Internal Energy Change

Idaho National Laboratory

ISL

RELAP5/MOD3.3 Added Features

- **Improved Screen Output**

  - Courant Limit Parameters, Time Step, Volume No., Pressure, Void Fraction, Junction or Volume Limit

  - Mass Error Parameters, Volume No., Pressure, Void Fraction, Noncondensable Fraction

  - Reason for Time Step Selection (dtmax, Courant, VapErr, etc.)

- **Restart Improvements**

  - Reset Option to Throw Away Beginning of Restart File

  - List of Restarts Available at End of Output File

  - Command Line -O and -R Options to Overwrite Output and Restart Files

Idaho National Laboratory

ISL

RELAP5/MOD3.3 Added Features

- **State Property Errors Debug Output**

  – List Properties in Volume with Error (Vapor, Liquid, etc.)

- **Junction-Based Courant Limit**

  – Complements the Current Volume-Based Courant Limit

- **Exponential Relaxation Time Smoothing**

  – Wall Heat Transfer

  – Sub-Cooled Boiling

- **Increased Number of Trips**

  – 10,000 maximum of Each Kind (was 1000)

- **Simplified 2080 Card Input**

  – -1 Option for Volume or Junction Parameter gets all

Idaho National Laboratory

ISL