Integration of GT-SUITE with NI VeriStand for SiL and HiL Applications

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SiL and HiL systems at Cummins

- Integrate models for system optimization and controls development and testing

- Aftertreatment
- Engine
- Vehicle
- Waste Heat Recovery
- Controls

Integrated System Models
What is VeriStand

- National Instruments product
- Software environment for configuring real-time testing applications.
- NI VeriStand helps you configure a multicore-ready real-time engine
- NI VeriStand can also import control algorithms, simulation models, and other tasks from NI LabVIEW software and third-party environments
Current HiL Simulink Environment

Simulink

Real Time
Future HiL Simulink Environment
VeriStand Advantages

- Simulink was not designed for use as integration environment
- VeriStand runs models in parallel very easy
  - Each of the components above can now run on individual processors and you are only limited to the number of processors your computer has
  - Less dependant on improvement in processing speed
- VeriStand allows easy transition to CIL from Pure Sim
Example of System Model in VeriStand

- Engine (platform specific)
- Engine system (common systems like cooling sys)
- Aftertreatment
- Controller interface
- Controls components
- Test cell
- Operator
- Route
- Transmission
- Transmission controller
- Vehicle
Mapping of Signals - VeriStand
GT-Power in VeriStand

- We asked Gamma to allow GT Power to run natively in VeriStand
  - Other option is to run the GT Power S-function wrapped in Simulink and compiled as dll, or in Simulink as a model
- Waste heat recovery components (2 phase flow) were needed in GTSuite-RT
- GT Power available natively in VeriStand 2009 & VeriStand 2010 in the form of dll’s
- Ability to run separate GT models on separate processors (e.g. waste heat recovery and the engine)
What is required to run natively in VS

- GT-Suite version 7.0 build 4 or newer
- Visual Studio 2005 or Visual Studio 2008 Express C++
- VeriStand 2009 or 2010

Must have the Simulink I/O block
Process for GTP in VeriStand

- Create model_params.h
  - Defines I/O of model, name of *.dat file

- Compile DLL
  - Using gtsuitert.bat compiles dll using Visual Studio C++
  - Single precision and double precision require separate directories for compiling

- Move dll to run directory with supporting files
  - Turbine
  - Compressor
  - Neural Nets
  - Fluid property files (.fld)
Conclusions and Future Work

- Implementing VeriStand for next generation engine work
- Working with Gamma to enable parameter tuning in VeriStand
  - Current method requires recompiling dll and editing model_params.h with tunable parameters
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