

# VisSim Real Time: The Windows Solution for Hardware-in-the-Loop Systems

VisSim/Real-Time is a VisSim option that provides the capability to couple a VisSim system model directly with a "real" process or controller. With VisSim/Real-Time, hardware-in-the-loop (HIL) systems can be configured and executed by interfacing VisSim plant or controller models with real-world hardware, such as manufacturing plants, chemical processes, motors, pumps and electric drives. The interface to real-world hardware is through computer I/O boards (National Instruments, Keithley-Metrabyte, Advantech and Data Translations); high-speed motion control interface cards; or serial port connections to Programmable Logic Controllers (PLCs) or Distributed Control Systems (DCSs).

VisSim/Real-Time is being used successfully in a wide variety of industries to :

- ▲ Develop initial control strategies
- ▲ Validate control strategies
- ▲ Perform off-line tuning
- ▲ Verify the feasibility of product/process transitions
- ▲ Train system operators (on plant model, not actual plant)

With VisSim/Real-Time, engineers can perform real-time simulation, data acquisition and control directly from Windows 3.1/95/NT. There is no code generation or programming involved, and there is virtually no difference between running a regular VisSim simulation and a real-time HIL system.

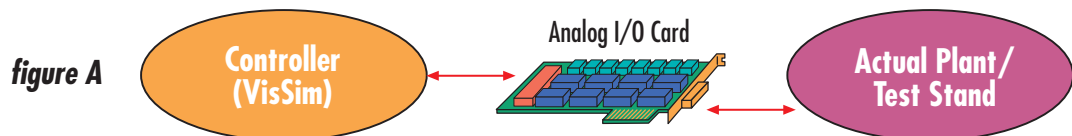
## Configuring a Hardware-in-the-loop System

Connecting VisSim to the real world is simple:

- ▲ Select the I/O card(s) from a large list of supported boards
- ▲ Read and write to I/O channels (digital, counter, volts, thermocouple) with real-time dataIn and dataOut function blocks

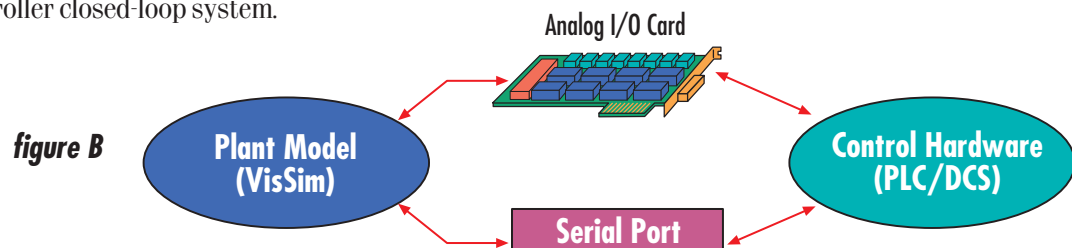
## Controller Validation, Off-Line Tuning, and Monitoring

Once a controller design is complete, most engineers want to test controller performance with a test stand or the actual plant (refer to figure A). With VisSim/Real-Time, an engineer can perform on-line controller validation by dynamically changing controller gains and observing the actual plant response — confirming that the controller design is correct or that further tuning is required.



Off-line tuning involves connecting the VisSim plant model to the target control hardware in order to validate the control algorithms (refer to figure B). When the control validation is complete, the control hardware is disconnected from the plant model and connected directly to the real plant. This process ensures faster, safer and less costly system and equipment ramp-ups. Off-line tuning is especially useful in the process control industries as it enables validation of controller design without any plant or equipment shut down. It is an equally important technique for use with expensive/sensitive equipment where a poorly designed and untested controller could result in damage to the equipment, costly downtime or inefficient performance.

During plant or equipment operation, VisSim/Real-Time can also be used to perform on-line monitoring of the plant-controller closed-loop system.

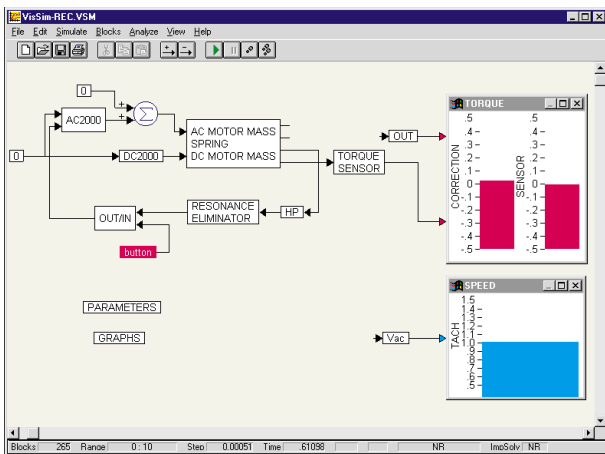


## VisSim/Real-Time at GE Motor & Drive Division

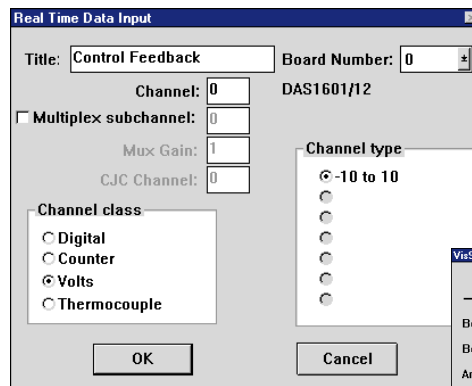
The Motor and Drive Systems Division of General Electric (GEMIS), based out of Salem, Virginia, is one of the largest manufacturers of electrical drive systems worldwide. Using VisSim and VisSim/Real-Time, engineers recently completed prototyping a Resonance Eliminator Controller (REC) for industrial drive systems used in metals rolling applications. The goal of the controller, according to Emil Kuelz and Sandy Gurian, System Engineers for GEMIS, is to reduce resonance vibrations in the shafts and rolls of the mechanical system. Kuelz and Gurian modeled the motor and mechanical system in VisSim, and then incorporated the REC. The REC computes a motor torque correction signal from shaft torque measurement, which in turn is applied to the mechanical system at a specific resonant frequency.

To test the design, Kuelz and Gurian used two PCs, each running VisSim/Real-Time. One PC contained the motor and mechanical system simulation; the other, the REC. VisSim's A-D/D-A real-time interface allowed the two models to exchange information. This configuration verified that controller performance would not be degraded by either time delays introduced by the A-D/D-A conversions or the precision of the 12-bit DAC. "The simulation results assured us that the REC would function properly when attached to the actual motor and mechanical system," said Kuelz.

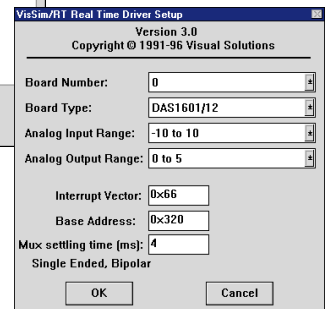
After verification, Kuelz and Gurian disconnected the PC with the REC from the PC with the motor and mechanical system simulation, and reconnected it to the real motor and mechanical system in GEMIS's in-house laboratory. The first time the REC was turned ON, it totally eliminated the mechanical system resonance.



▲ VisSim model of GE industrial drive system with Resonance Eliminator Controller. Upper plot shows amount of correction applied to motor torque. Lower plot shows drive speed.



▲ Real-Time I/O cards & data channels can be configured directly from VisSim via intuitive dialog boxes ▶



By developing and testing the REC in VisSim and VisSim/Real-Time, Kuelz and Gurian focused exclusively on proving the viability of the design. "The risks of connecting an unproved design to a large horse power electrical drive and mechanical system are great," said Kuelz. "If incorrectly designed and not thoroughly tested, it can cause motor, shaft, and coupling failure, resulting in a process outage costing millions of dollars."

## VisSim/Real-Time for Process Control Applications

HIL simulation is a critical requirement for the chemical, petrochemical, power, paper & pulp, pharmaceutical and food process industries. The cost of inefficient control strategies or poor product/ controller transitions is enormous. Companies, like DuPont (Non-Woven and AFS Spruance facility, Richmond, VA) are successfully using VisSim/Real-Time to validate, tune and monitor their process control equipment. For more details, request the DuPont case study.



Call now for a free VisSim/Real-Time demo disk: **1-800-VISSIM-1** or download it immediately from our web site: [www.vissim.com](http://www.vissim.com)

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