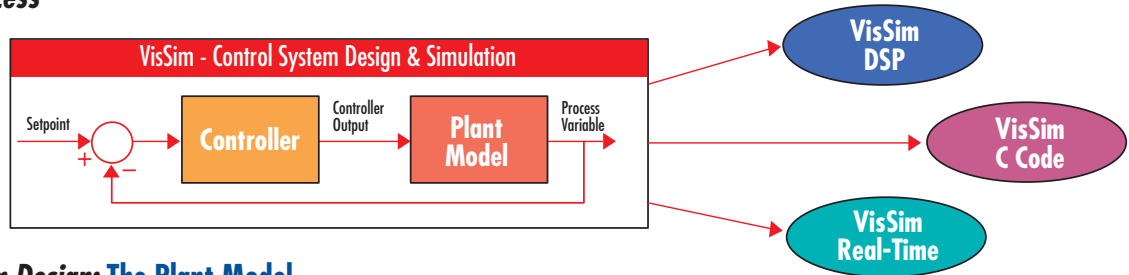


VisSim for Control System Design & Simulation

VisSim is a *Windows-based* program for the modeling and simulation of complex dynamic systems. VisSim combines an intuitive drag-and-drop block diagram interface with a powerful mathematical engine. The visual block diagram interface offers a simple method for constructing, modifying and maintaining complex system models. The mathematical engine provides fast and accurate solutions for linear, nonlinear, continuous time, discrete time, time varying and hybrid system designs.

VisSim is a fully integrated control system design environment where all design and simulation tasks can be completed *without writing a line of code*. Furthermore, VisSim offers *unprecedented ease-of-use* and consequently a *shorter learning curve* than competitive systems. Less time training — more time engineering!

Control System Design Process



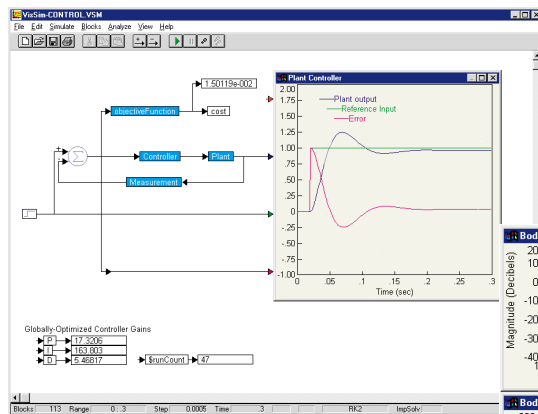
Control System Design: The Plant Model

The first step in control system design involves the creation of a plant model. VisSim enables engineers to easily build plant models, from a first principles perspective, by simply selecting and connecting predefined function blocks. Engineers can construct a wide range of models including linear, nonlinear, continuous, discrete, hybrid, SISO and MIMO systems. VisSim supports hierarchical design by allowing users to group blocks into compound blocks that represent components or sub-systems. Users can also create custom blocks in C, Fortran or Pascal and add them to the VisSim block library. There is virtually no limit to model size or complexity as VisSim supports over 5 million blocks per diagram.

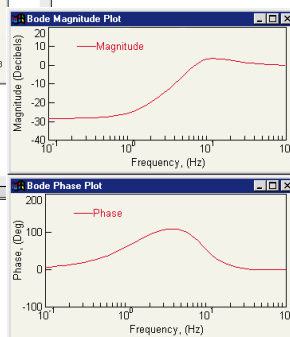
Once designed, the plant model is simulated to compare the plant model outputs to desired behavior. In VisSim, this is immediately visualized with plots, strip charts and other visualization blocks. The plant model can then be refined until the model accurately reflects the desired behavior (conforms to the actual plant or to specifications of the plant model). Plant models can also be derived through system identification methods which “reverse engineer” the plant model from actual plant/equipment data. For more details, request the System Identification data sheet.

Control System Design: Linearization of the Plant Model

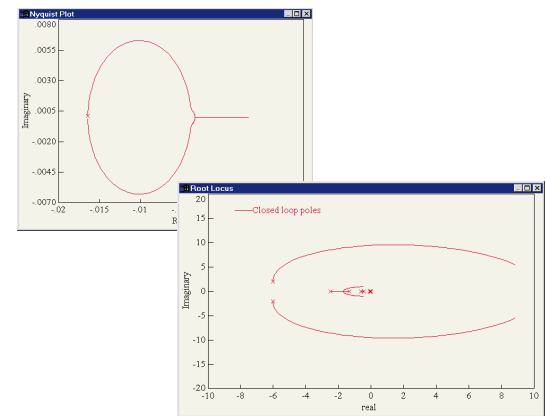
After the plant model is verified, the dynamics of a plant can be linearized with VisSim’s Analyze option. Analyze approximates the dynamics of a nonlinear system by linearizing the system about a specified operating point. Linearized systems can be represented in ABCD state space or transfer function form. With Analyze, an engineer can easily access transfer function information, edit zeroes and poles, and compute Nyquist, Bode and root locus plots.



Closed-loop control system where controller gains are tuned using parameter optimization; specified cost function provides parameter tuning flexibility



Bode magnitude and phase plots of the controller and plant subsystem

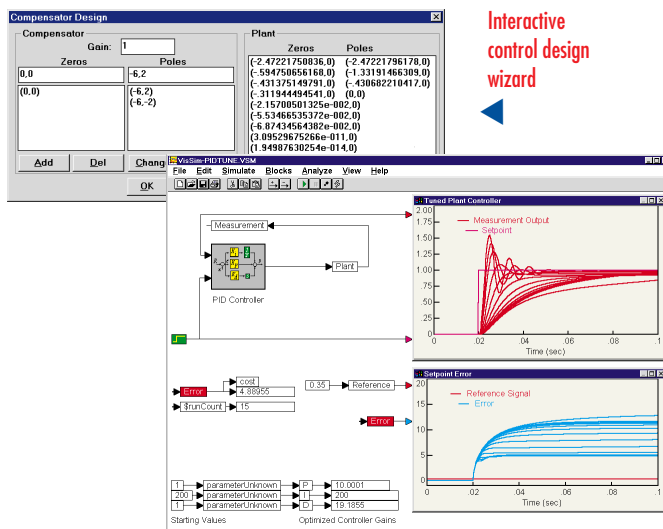


Root locus and Nyquist plots of a model

Control System Design: Controller Design

The next step is to design a controller for the plant model by interactively editing compensator zeroes and poles, and observing their combined behavior in Bode and root locus plots. Once the desired responses are obtained, the pole placement controller block is simply inserted into the VisSim diagram.

The preliminary pole placement controller is then connected to the plant model creating a feedforward or a feedback control loop. A simulation is run and the results of the simulation can be viewed in the form of plots. The stability of the closed-loop system can then be determined using Nyquist plots. In addition to pole placement controllers, VisSim provides pre-configured PI, PD and PID controllers that can be easily customized or optimized for specific user requirements.



Interactive control design wizard

Constrained optimization of controller gains of a PID controller with VisSim/OptimizePRO. The initial guess values and final optimized values of the PID controller gains are displayed in the bottom of the diagram

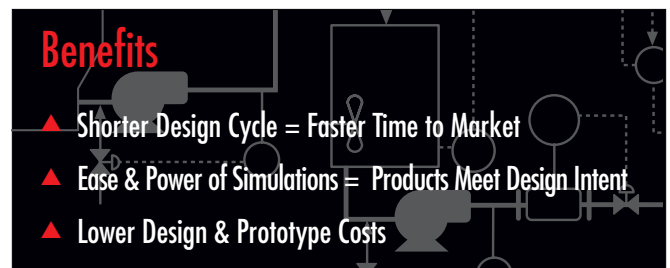
Control System Design: Simulation

Setting up a simulation in VisSim is simple. Connect the controller to the plant model and to a plot block. Then select the simulation parameters—for example start/end times and step size—and simulate. User-defined nonlinear control algorithms can also be incorporated directly into the simulation.

Simulations can be set up to run in interactive, batch or single-step modes. VisSim's highly interactive interface makes it easy to perform "what if" simulations. For example, a user can dynamically change parameter values like controller gains and VisSim will immediately display the corresponding changes in system behavior.

Both linear and nonlinear systems can be simulated with VisSim. Additionally, VisSim supports continuous, discrete time, multi-rate and hybrid simulations. Seven different integration algorithm options are available that offer a trade-off between speed and accuracy.

VisSim's OptimizePro can determine optimal values for design variables subject to user-defined constraints starting from initial user guess values. For example, OptimizePro can automatically calculate optimal PID controller gains that give minimal time to setpoint, plus minimal overshoot. It allows user-specified cost functions that can consider controller behavior, such as steady-state error, overshoot and rise and settling times. OptimizePro can even work with a physical system when coupled with VisSim's Real-Time option.



Real Time Hardware-in-the-Loop Solutions:

Once the control system design is complete, VisSim/Real-Time enables engineers to easily interface VisSim models with real-world hardware, such as manufacturing plants, chemical processes, motors, pumps and electric drives, through commonly available computer analog I/O boards.

Rapid Prototyping of DSP & Embedded Systems:

VisSim/DSP is a completely integrated, native Windows program for the rapid prototyping of control systems targeted for DSP (Digital Signal Processor) and embedded systems. VisSim/DSP includes integrated modules for Control System Design and Simulation, Automatic C Code Generation and Real-Time DSP Validation and Optimization.

VisSim C Code Generator:

VisSim/C-Code generates customizable ANSI C code directly from VisSim diagrams. The code can be compiled and run on any platform that supports an ANSI C compiler.

System Identification:

Derives a plant model directly from actual equipment/plant data.



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