

The design and simulation analysis of a continuous-controlled plant with a discrete-time state-variable controller and a discrete-time state observer is one of many assignments for my engineering students. VisSim is my tool of choice.

Victor Skormin
Distinguished Professor
Watson School of
Engineering
Binghamton University

VisSim/Analyze performs frequency domain analysis of a VisSim model or subsystem. You can perform open- and closed-loop system stability, and design control systems using classical control design tools, such as Bode and root locus frequency response.

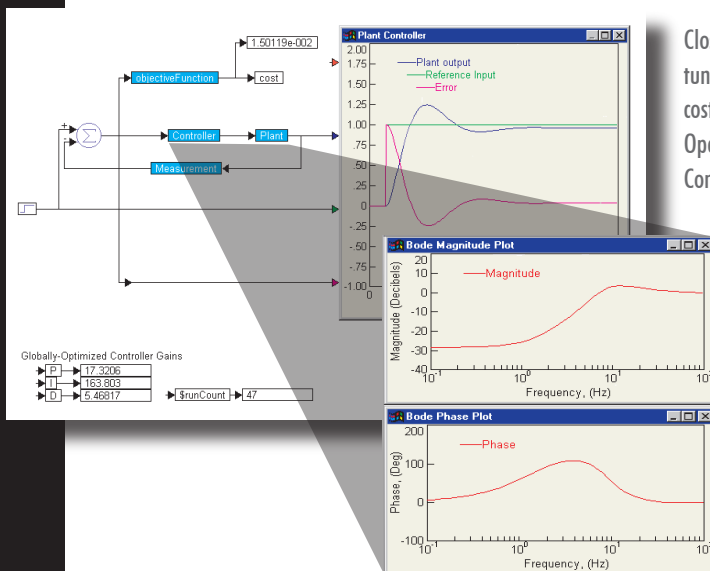
Discrete transfer function analysis: VisSim/Analyze supports analysis of discrete transfer functions. This lets you effectively handle the most general closed-loop system scenarios where a plant is modeled as a continuous dynamic system and the controller is a discrete (sampled data) system suitable for easy implementation on microcontroller hardware.

Interactive controller design: Designing a controller for a plant model is performed interactively by editing compensator zeros and poles, and observing the combined controller-plant behavior in Bode and root locus plots. Once the desired responses are obtained, the resulting controller block is inserted into the VisSim diagram.

The controller is connected to a plant model creating a feedforward or feedback control loop. A simulation is run in VisSim and the results are easily viewed in plots. The stability of the closed-loop system can then be determined in Nyquist plots.

HIGHLIGHTS

- Linearize nonlinear systems
- Analyze discrete transfer functions
- Generate ABCD state-space matrix
 - Screen display
 - .M/.MAT file exportation
 - Numerical perturbation for creating SISO ABCD state-space matrices
- Find transfer function equivalent
- Bode phase and magnitude versus log frequency plots
- Root locus plots
- Nyquist plots
- Compensator design



Closed-loop control system where controller gains are tuned using parameter optimization. A user-specified cost function provides parameter tuning flexibility (left). Open-loop Bode magnitude and phase plots of the Controller and plant subsystem (below, left).

System Requirements

- Professional VisSim 8.0
- Windows XP, Vista, or 7
- 128 MB RAM
- 125 MB hard disk space

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Phone: 1-800-VISSIM-1

Email: sales@vissol.com

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Distribuito da:

PATRUCCO snc
Via Clemente, 12
10143 TORINO
Tel. 011-4375549
Fax 011-4375986
info@patrucco.it
www.patrucco.it

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