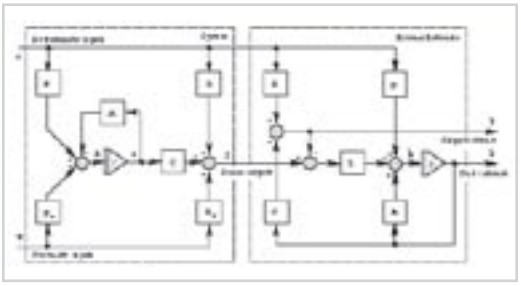
MATHEMATICA®
CONTROL SYSTEM PROFESSIONAL

COMPREHENSIVE CONTROL SYSTEM ENVIRONMENT WITH INTEGRATED SYMBOLIC CAPABILITY

Control System Professional offers an object-oriented environment for solving common problems in control and systems areas within *Mathematica*. This robust application package covers all steps from creating and manipulating symbolic and numeric models to analyzing, designing, and simulating control systems. With *Control System Professional*, you can use analytical solutions to study relationships between design elements, gain added insight into complex composite systems, and use numerical solutions for plotting and testing. You can also handle linear MIMO (multi-input, multi-output) systems as well as SISO (single-input, single-output) systems in both time and frequency domains and take advantage of the linearization techniques provided in the package for nonlinear systems.



Control System Professional includes hundreds of examples and case studies that demonstrate the use of this application in many fields including mechanical, electrical, chemical, and aerospace engineering.

KEY BENEFITS

- Provides integrated numeric and symbolic capabilities, which enables you to get analytical solutions to many control problems, such as continuous-to-discrete time conversions, state-space analysis and design, and model building (including estimator and controller design).
- Combines all system information into convenient data structures that can seamlessly pass results from one function to another providing a unified system representation; it automatically recognizes whether your equations are discrete or continuous and chooses algorithms accordingly.
- Allows you to increase the working precision in all calculations to avoid meaningless results that would occur when the result is prone to numerical errors.

For more information, visit **www.wolfram.com/csp**.

MATHEMATICA®
CONTROL SYSTEM PROFESSIONAL

Control System Professional helps you design, analyze, and simulate control systems with the full symbolic, numeric, and graphical capabilities of *Mathematica*.

Control System Professional Features

Time-Domain Response Analyses
Provides symbolic analysis capabilities for solving state equations ▪ Simulates system behavior numerically ▪ Includes step, impulse, and ramp response function examples

Collection of Classical Methods
Handles arbitrary transfer functions and rational polynomial transfer functions with frequency response plotting routines ▪ Generates Bode, Nyquist, and Nichols plots ▪ Reduces complexity for MIMO systems with singular value plots ▪ Plots and animates the root loci, providing information on their direction and evolution

Wide Range of System Interconnections
Includes elementary serial (cascade), parallel, and feedback interconnections ▪ Constructs arbitrary complex composite systems from building blocks

Controllability and Observability
Determines and computes controllability and observability ▪ Computes the controllability and observability matrices and Gramians ▪ Solves the continuous and discrete matrix Lyapunov equations ▪ Computes the dual to the input system

Realizations Construction and Conversion
Selects controllable and observable subsystems; finds the minimal realizations ▪ Computes the Kalman and Jordan canonical forms ▪ Constructs internally balanced realizations ▪ Cancels common zero-pole pairs in transfer functions ▪ Converts between equivalent realizations with similarity transforms

Feedback Control Systems Design
Computes the feedback for the eigenvalue assignment using Ackermann's formula or the robust algorithm ▪ Finds the estimator for state reconstruction

Optimal Control Systems Design
Designs the optimal feedback for linear system and quadratic cost functions (i.e., solves continuous and discrete linear-quadratic optimal control problems) ▪ Finds the optimal solution to the output regulator problem ▪ Solves the continuous and discrete algebraic Riccati equations ▪ Finds the discrete equivalent to the continuous regulator ▪ Finds the Kalman estimator and filter for stochastic systems

Nonlinear Control Systems
Provides a linearization tool for constructing linear models of nonlinear systems ▪ Makes rational polynomial approximations of nonlinear systems

General *Mathematica* Features

Over 1900 built-in functions, including the world's largest collection of advanced algorithms for numeric and symbolic computation, discrete mathematics, statistics, data analysis, graphics, visualization, and general programming

Multi-paradigm symbolic programming language with support for procedural, functional, list-based, object-oriented, and symbolic programming constructs

Automatic precision control and support for exact integers of arbitrary length, rationals, floating-point real and complex numbers, and arbitrary-precision real and complex numbers

User-defined or automatic algorithm selection for optimal performance

Fully programmable 2D and 3D visualization with over 50 built-in plot types

Fully integrated piecewise functions

High-speed numerical linear algebra with performance equal to specialized numeric libraries

High-performance optimization and linear programming functions

Wide-ranging support for sparse matrices

Flexible import and export of over 70 data, image, and sparse matrix formats

Industrial-strength string manipulation

Highly optimized binary data I/O

Built-in universal database connectivity

Integrated web services support

Language bindings to C, Java, .NET, and scripting languages

MathematicaMark™ benchmarking tool

Toolkit for creating graphical user interfaces

Technical Requirements

Control System Professional requires *Mathematica* 4.2 or later and is available for Windows, Mac OS X, Linux, and Unix.
For a more detailed list, see www.wolfram.com/mathematica/platforms.

Related Products

The *Mathematica* Applications Library is a continually expanding collection of software used in conjunction with *Mathematica* to quickly handle specific tasks in engineering, finance, data analysis, and many other technical areas.

Some of the software packages available are:
Neural Networks ▪ *Signals and Systems* ▪ *Digital Image Processing* ▪ *Mechanical Systems* ▪ *Wavelet Explorer* ▪ *Time Series* ▪ *Experimental Data Analyst* ▪ *Fuzzy Logic*

Find the latest products and buy online throughout the world at **store.wolfram.com**. Choose from over 50 technical software products, more than 200 books, *Mathematica* posters, T-shirts, and other items.

For more information, visit **www.wolfram.com/csp**.

WOLFRAMRESEARCH

WOLFRAM RESEARCH, INC.
info@wolfram.com ▪ +1-217-398-0700

WOLFRAM RESEARCH EUROPE LTD.
info@wolfram.co.uk ▪ +44-(0)1993-883400

WOLFRAM RESEARCH ASIA LTD.
info@wolfram.co.jp ▪ www.wolfram.co.jp
Reseller support only

MKT2001 493332 0405.jas