

SchematicSolver

Mathematica® Application

SYMBOLIC SIGNAL PROCESSING
SOFTWARE IMPLEMENTATION
MOUSE DRIVEN INTERACTIVE DRAWING TOOL



“SchematicSolver is a kind of front processor for Mathematica. It is a fantastic tool for researchers and engineers in fields such as circuits, systems, and signal processing. It is easy to use.”

Professor Dr. Akinori Nishihara,
Tokyo Institute of Technology, Japan

What is SchematicSolver?

SchematicSolver is a powerful, easy-to-use tool for schematic capture and symbolic analysis, processing, and implementation of systems in Mathematica.

Using SchematicSolver's unique capabilities and mixed symbolic-numeric processing, you can perform fast, accurate simulations of discrete-time and continuous-time systems.

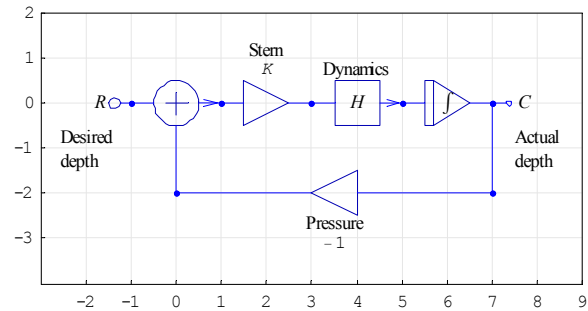
Demo system



In order to analyze, design and evaluate a real-life system, for example a diving submarine, the description of its components and their interconnections must be put into a suitable form. Let's **make a graphical representation** of the system – its block diagram.

Draw block diagram

SchematicSolver, a mouse-driven interactive drawing tool, quickly and effortlessly creates the schematic of the system.



Solve system

SchematicSolver symbolically solves the system directly from the schematic by generating the equations describing the system

```
Y[{-1, 0}] == R
Y[{1, 0}] == Y[{-1, 0}] + Y[{0, -2}]
Y[{3, 0}] == K Y[{1, 0}]
Y[{5, 0}] == H Y[{3, 0}]
Y[{7, 0}] ==  $\frac{Y[5,0]}{s}$ 
Y[{0, -2}] == -Y[{7, 0}]
```

and computing the system transfer functions.

$$\frac{K(s+1)^2}{s^3 + Ks^2 + (2K + 0.1)s + K}$$

Implement system

SchematicSolver generates software implementation directly from the schematic.

```

Software_Implementation.nb
■ Software Implementation

systemImplementation[({inputSample_ = 0,
a2_ = 0, a3_ = 0, b1_ = 0, b2_ = 0, b3_ = 0,
dYdy2_ = 0, dYdy1_ = 0})] := Module[
{Ydy10, Ydy8, Ydy6, Ydy4, Ydy2,
Ydy1, Ydy3, Ydy5, Ydy7,
Ydy9, Ydy0, Ydy4, Ydy6, Ydy10},
Ydy10 = inputSample;
Ydy9 = dYdy7;
Ydy3 = dYdy1;
Ydy8 = b3 Ydy10;
Ydy4 = b2 Ydy10;
Ydy10 = b1 Ydy10;
Ydy8 = a3 Ydy10;
Ydy6 = a2 Ydy10;
Ydy1 = Ydy8 - Ydy8;
Ydy5 = Ydy4 + Ydy3;
Ydy7 = Ydy5 - Ydy4;
Ydy10 = Ydy8 + Ydy8;
{Ydy10, Ydy7, Ydy1}];
                    
```

Symbolic signal processing

SchematicSolver symbolically process data sequences.

Symbolic_Processing.nb

■ Symbolic Signal Processing

```

In[1]:= H = DiscreteSystemTransferFunction[IRSystem] /. systemValues // First;
% // DiscreteSystemDisplayForm

Out[12]= Display Form

$$\frac{1 + 2z^{-1} + z^{-2}}{1 + Kz^{-2}}$$


In[13]:= h = DiscreteSystemProcessingSISO[impulseSequence, H] // First

Out[13]= {1, 2, 1 - K, -2K, -(1 - K)K, 2K^2, (1 - K)K^2, -2K^3, -(1 - K)K^3, 2K^4, (1 - K)K^4}
                    
```

Who's It For?

- **Educators** and **students** who want more efficient, practical teaching and learning
- **Practitioners** who are too busy to master the theoretical background of the design procedures and algorithms
- **Industry designers** responsible for products with short time-to-market
- **Beginners** who want to learn and experiment with system analysis, implementation, and design
- **Advanced users** who explore and prototype new design algorithms

Easy to use and learn

- Mouse-driven, **interactive** drawing tool based on *Mathematica*'s built-in functions and palettes
- **Powerful** functions constructed so only a minimal amount of information has to be specified by the user
- Well-organized **palettes** for drawing schematics and solving systems with a single click
- **Extensive online documentation** including illustrative application examples

Powerful modeling and simulation environment

- **Visualization** tools for drawing and viewing system models
- Unique capabilities in mixed symbolic-numeric processing for **fast and accurate simulations** of discrete-time (digital) and continuous-time (analog) systems

Fast and reliable

- Quickly and effortlessly creates schematics of systems
- Symbolically solves the system directly from the schematic by generating the equations describing the system and computing the system-response and transfer functions
- Special function included to plot the frequency response
- Self-contained and stand-alone document that contains text, graphics, formulas, high-quality schematics, and the symbolic solutions to systems

Teams up with other *Mathematica* applications

- Complements *Control System Professional* with tools for drawing and solving systems described by block diagrams
- Provides objects such as transfer functions for further analysis with *Signals and Systems*
- Has access to all *Mathematica* capabilities to perform further manipulations on results returned by *SchematicSolver*

Why should I use *Mathematica* and *SchematicSolver*?

- The most powerful built-in functions not available in other software (like MATLAB)
- Rich programming language: More compact code compared to other environments
- More efficient programming: faster development of complex applications (shorter time-to-market)
- Easier to maintain and upgrade packages

SIMULINK vs. *SchematicSolver* + *Mathematica*

- *SchematicSolver* + *Mathematica* perform both, symbolic and numeric analysis, SIMULINK is numeric-only software
- *Mathematica* notebook is a standalone and self-contained document that contains text, graphics, formulas, high-quality schematics

In short ...

- *SchematicSolver* is a new *Mathematica* application that is ...
- Easy to use
- Targeted at both industry and academia
- Ready to run (requires no programming)

Developed and supported by

Prof. Dr *Miroslav Lutovac* and
Prof. Dr *Dejan Tomic*

Buying info

www.SchematicSolver.com