

# Communications Toolbox 4

## Design and analyze algorithms for the physical layer of communication systems

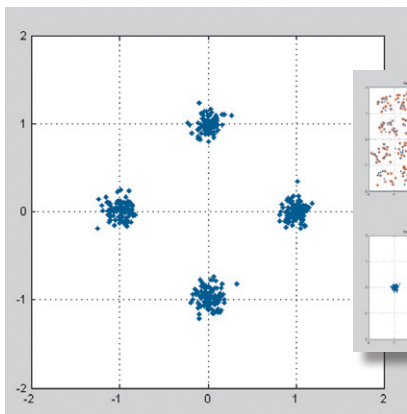
Communications Toolbox extends the MATLAB® technical computing environment with functions, plots, and a graphical user interface (GUI) for exploring, designing, analyzing, and simulating algorithms for the physical layer of communication systems.

You can execute Communications Toolbox functions from the MATLAB command line, the BERTool GUI, and with your custom MATLAB scripts and functions. The MATLAB editor/debugger and graphical user interface development environment (GUIDE) accelerate the development of your system simulations.

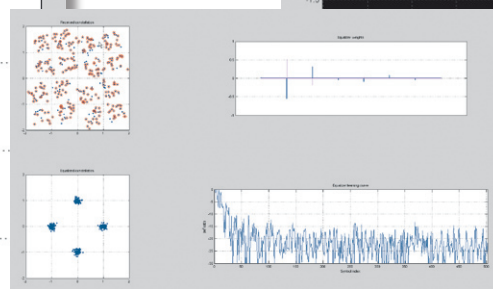
Communications Toolbox helps you create algorithms for commercial or defense systems, such as mobile handsets and base stations, wired and wireless local area networks, and digital subscriber lines. You can also use it in research and education for communication systems engineering.

### KEY FEATURES

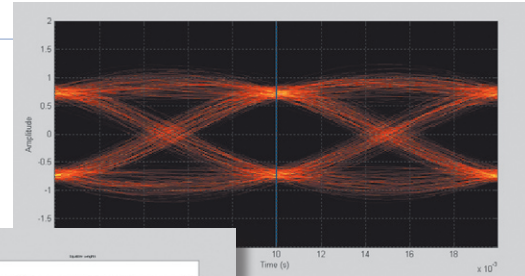
- Functions for designing the physical layer of communications links, including source coding, channel coding, interleaving, modulation, channel models, and equalization
- Graphical plots for visualizing communications signals, such as eye diagrams, constellations, and channel scattering functions
- Graphical user interface for comparing the bit error rate of your system with a wide variety of proven analytical results
- Standard channel models COST 207, GSM/EDGE, and HF ionospheric, for rapidly evaluating system performance under a wide variety of propagation conditions
- Channel visualization tool for visualizing and exploring time-varying communications channels



A plot from the `scatterplot` function that displays the constellation of a received complex baseband signal.



A received constellation shown pre- and post-equalization using a six-tap fractionally spaced forward filter and two feedback weights.



A plot from the `eyediagram` object that displays the quality of an equalized complex baseband signal.

## Sample Functions

Modulate and demodulate using baseband or bandpass techniques

Use linear, cyclic, BCH, Hamming, RS block encoders and decoders

Convolutionally encode and decode

Analyze channel propagation using COST 207 and GSM/EDGE models with per-path K factors and Doppler spectra

Simulate HF propagation using ionospheric channel model, including ITU-R F.1487

Visualize channel scattering functions

Equalize received signals using LMS, RLS, CMA, or MLSE algorithms

Analyze signal characteristics using eye diagram and scatter plot

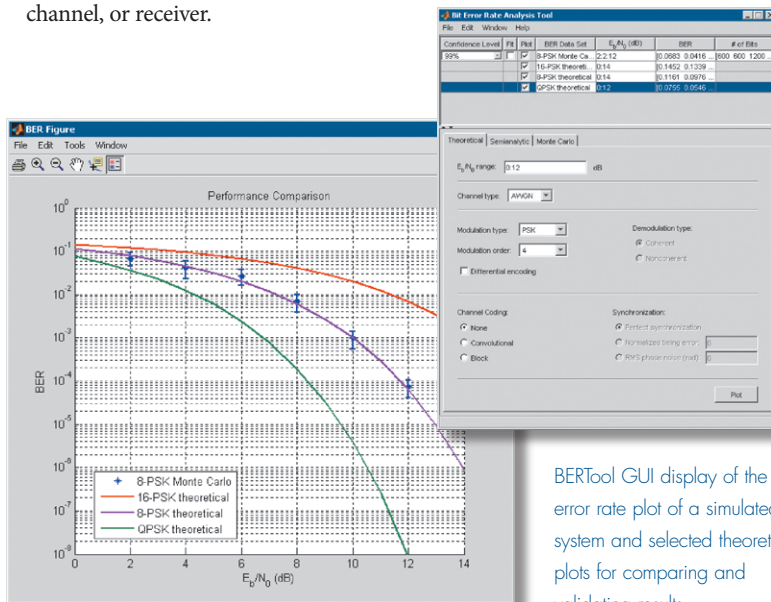
Display simulated error rates vs. theoretical bounds using BERTool

## Physical Layer Functions

Communications Toolbox uses MATLAB arrays to represent the signals in your communication system. As a result, you can divide the physical layer into a cascade of algorithms. Each algorithm is represented by a MATLAB function that acts on the signal arrays. By cascading the output array of one function as an input array to the next function, Communications Toolbox helps you focus your design on the transmitter, channel, or receiver.

## Specialized Graphical Plots and GUI

Communications Toolbox provides specialized plots for communication engineering, such as eye diagrams, constellation plots, and bit error rate versus signal-to-noise ratio plots. With the BERTool GUI, you can combine data from several simulation runs and compare the results with theoretical benchmarks in one combined plot window.



BERTool GUI display of the bit error rate plot of a simulated system and selected theoretical plots for comparing and validating results.

## Required Products

MATLAB

Signal Processing Toolbox

## Related Products

Simulink®. Simulation and Model-Based Design

**Communications Blockset.** Design and simulate the physical layer of communication systems and components

**RF Blockset.** Design and simulate the behavior of RF systems and components in a wireless system

**RF Toolbox.** Design, model, and analyze networks of RF components

**Signal Processing Blockset.** Design and simulate signal processing systems and devices

For more information on related products, visit [www.mathworks.com/products/communications](http://www.mathworks.com/products/communications)

## Platform and System Requirements

For platform and system requirements, visit [www.mathworks.com/products/communications](http://www.mathworks.com/products/communications)

## Resources

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