Edit, simulate, compile and deploy designs with MATLAB® for computation-intensive applications. Model-Based Design Toolbox (MBDT) is a comprehensive collection of tools that plug into the MATLAB and Simulink® model-based design environment to support fast prototyping, verification and validation for real targets based on NXP microcontrollers.

Our Model-Based Design Toolbox (MBDT) includes an integrated Simulink-embedded target supporting NXP MCUs for direct rapid prototyping and built-in support for software- and processor-in-the-loop (SIL and PIL) development workflows, systems and peripherals device interface blocks and drivers, a target-optimized Math and Motor Control library set (AMMCLib) for efficient execution on the target automotive MCUs and Real-Time Control Embedded Software Motor Control and Power Conversion Libraries (RTCESL) for other MCUs, and bit-accurate simulation results in the Simulink simulation environment.

MBDT helps to generate all the code required automatically (including initialization routines and device drivers) to start up the MCU and run complex applications such as motor control algorithms and sensor-based and communication protocols while supporting builds with multiple compilers.

MBDT generates all the code required to start up the MCU and run the application code, while supporting builds with multiple compilers. MBDT supports a wide range of applications development and helps enable control engineers and embedded developers to shorten project life cycles. MBDT includes:

- Integrated Simulink-embedded target supporting NXP MCUs for direct rapid prototyping and PIL workflows
- Systems and peripherals device interface blocks and drivers
- Target-optimized math and motor control algorithm blocks for efficient execution on the target MCU
- Bit-accurate simulation results in the Simulink simulation environment
TARGET APPLICATIONS

- Embedded system development
- Industrial automation
- Automotive control design
- Machinery real-time systems
- Aerospace and defense

FEATURES

- Built-in support for direct code download to the target MCU through the RAppID Boot Loader utility
- Out-of-the-box applications for a wide set of MCU peripherals
- Complete cost-free build toolchain for embedded applications
- Built-in support for NXP FreeMASTER—a real-time debug monitor and data visualization tool interface. It provides visibility into the target MCU for algorithm calibration and tuning, making it suitable for advanced control systems and those required by motor control development, with:
  - Monitor signals in real time on the embedded target
  - Data logging
  - Signal capture
  - Parameter tuning

PRODUCT REQUIREMENTS

MATLAB | Simulink | Embedded coder
MATLAB coder | Simulink coder

SUPPORTED NXP MICROCONTROLLERS/DRIVER BLOCKS

*Earlier released products only support 32-bit

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# AUTOMOTIVE MATH AND MOTOR CONTROL LIBRARIES (AMMCLIB)

**Embedded Software and Motor Control Libraries**

## GENERAL TRIGONOMETRIC AND BASIC FUNCTIONS (GFLIB)
- Trigonometric functions
- Limitation functions
- PI controller functions
- Linear interpolation
- Hysteresis function
- Signal integration function
- Sign function
- Signal ramp function

## GENERAL MOTOR CONTROL FUNCTIONS (GMCLIB)
- Clark transformation
- Park transformation
- Duty cycle calculation
- Elimination of DC ripples
- Decoupling of PMSM motors

## GENERAL DIGITAL FILTERS FUNCTIONS (GDFLIB)
- Finite impulse filter
- Moving average filter
- First order infinite impulse filter
- Second order infinite impulse filter

## MATHEMATICAL FUNCTION LIBRARY (MLIB)
- Absolute value
- Add
- Divide
- Multiply, multiple accumulate, multiply-subtract, multiply-subtract-from
- Negative
- Normalize
- Shift, bit shift
- Subtract
- Vector multiply accumulate

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# REAL-TIME CONTROL EMBEDDED SOFTWARE MOTOR CONTROL AND POWER CONVERSION LIBRARIES (RTCESL)

## ALGORITHM (16 AND 32-BIT FIXED POINT, 32-BIT FLOATING POINT)
- Absolute value
- Negation
- Conversion
- Conversion with rounding
- Addition
- Leading-bit count
- Subtraction
- Single-bit Shift
- Multi-bit Shift
- Multi-bit bidirectional shift
- Multiplication
- Multiplication with negation
- Multiplication with rounding
- Multiplication with negation and rounding
- Multiplication-accumulation
- Multiplication-negation-accumulation
- Multiplication-subtraction
- Multiplication-negation-accumulation with rounding
- Multiplication-accumulation with rounding
- Multiplication-subtraction with rounding
- Division (single quadrant)
- Signed division
- Reciprocal (single-quadrant)
- Signed reciprocal
- Sign
- Binary logarithm
- Saturation
- Sum of four addends
- Subtraction of 3 subtrahends from the minuend