

AUTOMOTIVE MATH AND MOTOR CONTROL LIBRARY (AMMCLib) SET

The Automotive Math and Motor Control Library (AMMCLib) set is a collection of production-ready and easy-to-use software libraries for rapid development of motor control and other real-time embedded systems.

OVERVIEW

The AMMCLib set provides essential building blocks for rapid development of automotive embedded applications with high-performance arithmetic, trigonometric, and digital signal processing math functions.

A significant portion of the library supports both sensor-based and sensorless motor control application strategies, while advanced motor control functions expand the speed range of a permanent magnet synchronous motor (PMSM) and allow on-the-fly startup of a sensorless control loop.

KEY BENEFITS

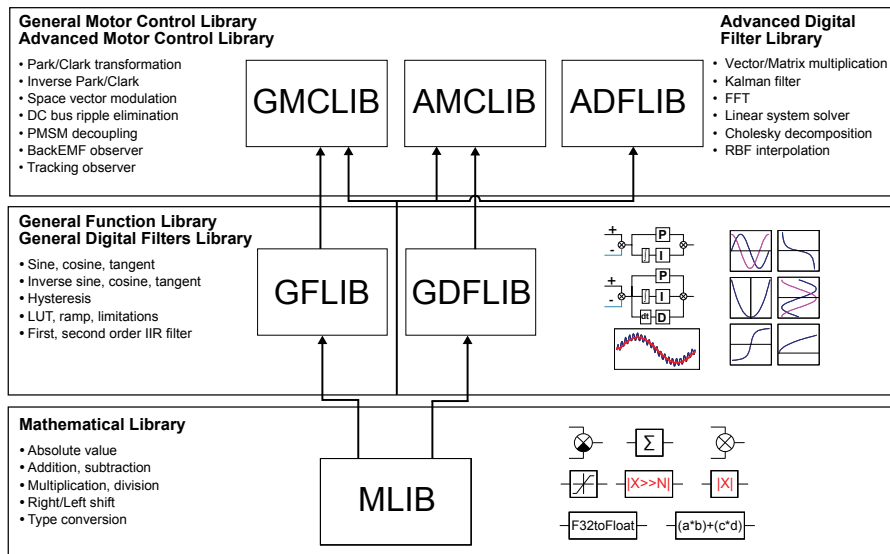
- Enables rapid development of a wide range of sensor-based and sensorless motor control applications
- Goes beyond standard motor control—on-the-fly startup, seamless PMSM field weakening
- Saves development cost and time—years of research and expert knowledge packed in one off-the-shelf, easy-to-use software package
- Offers long-term support of new and old MCUs—new features regularly released for all supported platforms and an active NXP community forum
- Supports many NXP automotive MCU families, easy migration between platforms
- Provides common interface and CPU-specific internal optimizations for maximum performance: SPE, LSP, Arm® Neon™, Arm DSP for Cortex®-M
- Offers detailed user documentation providing usage guide and code examples
- Supported by application notes, motor control development kits, tuning and debugging tools, and free and premium compilers



AMMCLIB FEATURES

- Layered architecture supporting fixed-point fractional 16-/32-bit and single-precision floating-point arithmetic
- Production-ready, pre-compiled object code, and source code variants
- Developed according to SPICE Level 3, ISO 9001/TS 16949
- Quality packs available for inclusion into automotive processes
- Supports free and premium compilers
- Independent of target platform peripherals
- MATLAB® Simulink® models for all functions
- Model-based code generation w/ Simulink Embedded Coder®
- Integrates with NXP tools:
 - S32 Design Studio (S32DS)
 - Model-Based Design Toolbox (MBDT)
 - Motor Control Application Tuning (MCAT) tool

AMMCLib HIERARCHY



GENERAL MOTOR CONTROL FUNCTIONS (GMCLIB)

- 2D vector coordinate transforms, scale, and rotation
- Beta projection
- Clark transformation
- DQ decoupling for PMSM motors
- Duty cycle calculation
- Elimination of DC ripples
- Park transformation
- PWM spectrum spreading
- 6-phase space vector modulation
- 6-phase Clarke/Park transforms
- Single shunt current reconstruction

GENERAL TRIGONOMETRIC AND CONTROLLER FUNCTIONS (GFLIB)

- Base-10 logarithm: scalar + vector
- Hysteresis function
- Limitation functions
- Linear interpolation
- PI/PID controllers
- Sign function
- Signal integration function
- Signal ramp function
- Trigonometric functions
- Vector minimum

ADVANCED MOTOR CONTROL FUNCTIONS (AMCLIB)

- BEMF observer
- Tracking observer
- FOC current loop controllers
- FOC speed loop controllers with PMSM field weakening
- Active windmilling: PMSM speed/position detection
- PMSM electrical parameters estimator

GENERAL DIGITAL FILTERS FUNCTIONS (GDFLIB)

- Exponential moving average filter
- Finite impulse filter
- First order infinite impulse filter
- Second order infinite impulse filter

ADVANCED DIGITAL FILTERS FUNCTIONS (ADFLIB)

- Cholesky decomposition + linear solver
- Dot product
- Element-wise vector selector
- Fast Fourier transform (FFT)
- Generalized matrix/vector multiply-accumulate
- Linear Kalman filter
- Radial basis function interpolation
- Third-octave filter bank
- Vector copy
- Vector windowing

SATURATED ARITHMETIC AND BITWISE FUNCTIONS (MLIB)

- 2D dot product
- Absolute value
- Bitwise shifts
- Fixed-point normalization
- Format conversions
- Fused multiply-add/subtract
- Rounding
- Saturated and modulo arithmetic
- Vector scale

TARGET APPLICATIONS

- Motor control: pumps, fans, valves, body and comfort, parking brake, starter/alternator, electric powertrain
- Engine control: sensor processing and fusion, advanced simulation for calibration

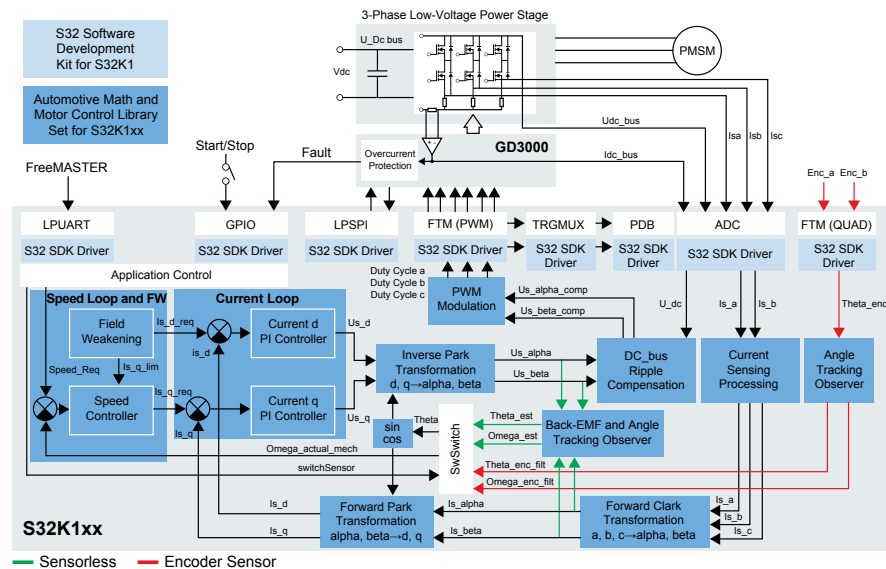
SUPPORTED COMPILERS:

- S32 Design Studio
- CodeWarrior®
- WindRiver® Diab
- Cosmic Software
- IAR for Arm
- Green Hills Software

SUPPORTED DEVICES

		GMCLIB	AMCLIB	ADFLIB	GFLIB	GDFLIB	MLIB
S32K MCUs	S32K1x, S32K3x	✓	✓		✓	✓	✓
S32S MCUs	S32S2xx	✓	✓	✓	✓	✓	✓
S32V processors	S32V234	✓	✓	✓	✓	✓	✓
S12 MagniV® MCUs	S12ZVM	✓	✓		✓	✓	✓
MPC57xx MCUs	MPC577xC, MPC5775E, MPC577xK, MPC577xM, MPC574xC, MPC574xG, MPC574xP, MPC574xR	✓	✓		✓	✓	✓
MPC56xx MCUs	MPC560xB, MPC560xP, MPC564xL, MPC567xF, MPC567xK	✓	✓		✓	✓	✓
KEA MCUs	KEA	✓			✓	✓	✓

FOC AMMCLib USE CASE EXAMPLE



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Document Number: AMAMOCLSFS REV 5