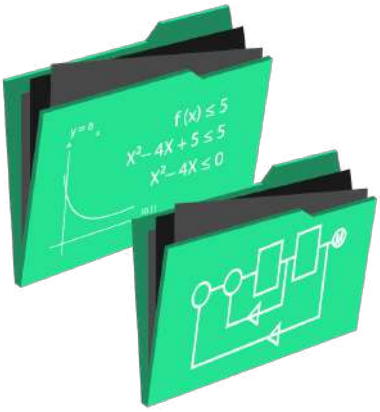
A rich collection of advanced software and automotive algorithm to boost performance



OLEA® LIB

- Configure and **customize** complex algorithms
- Boosts application performance and enabling rapid time to market
- **Cutting edge** inverter, DC-DC converter and OBC control systems
- **ISO 26262 - ASIL-D** certified for the design of safe systems
- Design and development **turnaround in minutes** with full integration into OLEA® COMPOSER

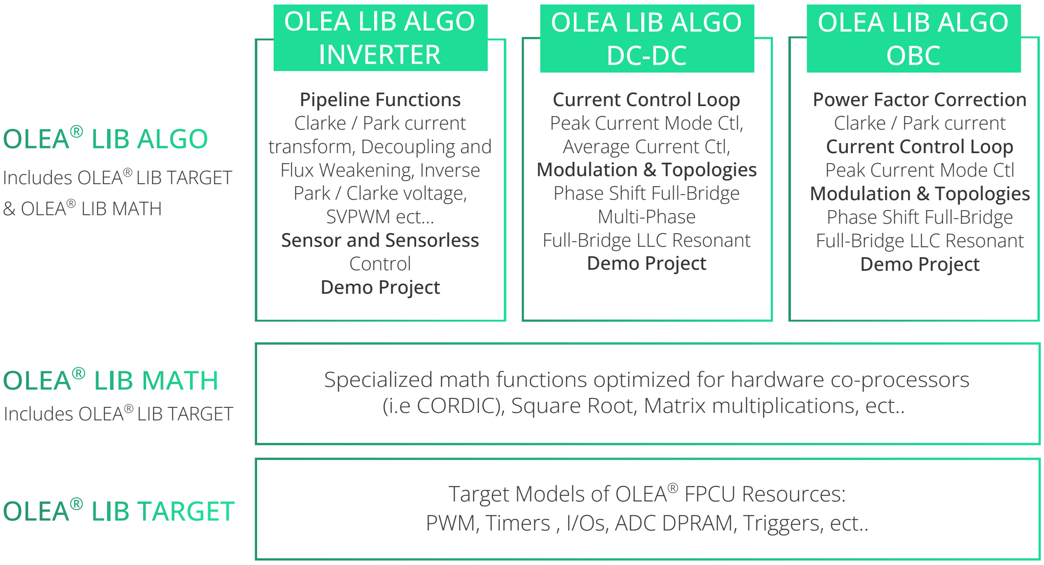
State of the art control algorithms for fast time to market

Boost performance: software and algorithms included into OLEA® LIB have been optimized for OLEA® FPCU and take all the benefits of the hardware resources and accelerators available (mathematical units, DSP functions and standard peripherals) to deliver the highest achievable performance and integration.

Shorten development times: by using OLEA® LIB , developers drastically reduce the time required to develop, optimize, test and calibrate their algorithm's on OLEA® FPCU.

Configurable Functions: each function in the library is configurable upon multiple parameters and is fully integrated and recognizable on the OLEA® COMPOSER.

The OLEA® library is packaged into three complementary building blocks (OLEA® LIB TARGET, MATH and ALGO) that offer incremental levels of performance and content. Each block offers unique capabilities and functions to meet application needs. These building blocks are available as reference and target models for MATLAB® Simulink, or as HDL pre-defined blocks, and tuned for best use of OLEA® FPCU. Models out of OLEA® LIB are directly usable within OLEA® COMPOSER for MiL simulations and automatic code generation.



OLEA® LIB ALGO

Includes OLEA® LIB TARGET & OLEA® LIB MATH

OLEA LIB ALGO INVERTER

Pipeline Functions
Clarke / Park current transform, Decoupling and Flux Weakening, Inverse Park / Clarke voltage, SVPWM ect…
Sensor and Sensorless Control
Demo Project

OLEA LIB ALGO DC-DC

Current Control Loop
Peak Current Mode Ctl, Average Current Ctl,
Modulation & Topologies
Phase Shift Full-Bridge
Multi-Phase
Full-Bridge LLC Resonant
Demo Project

OLEA LIB ALGO OBC

Power Factor Correction
Clarke / Park current
Current Control Loop
Peak Current Mode Ctl
Modulation & Topologies
Phase Shift Full-Bridge
Full-Bridge LLC Resonant
Demo Project

OLEA® LIB MATH

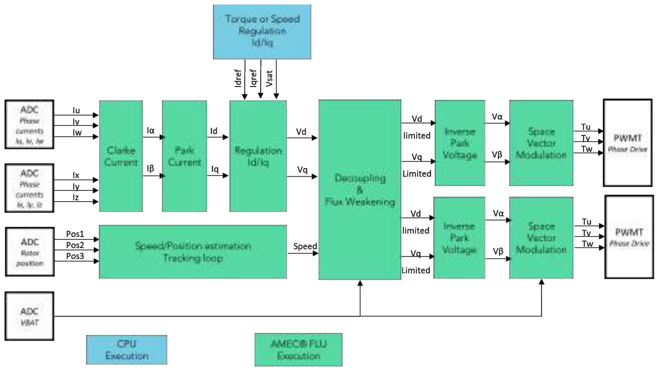
Includes OLEA® LIB TARGET

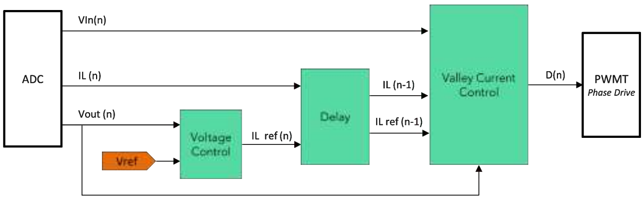
Specialized math functions optimized for hardware co-processors (i.e CORDIC), Square Root, Matrix multiplications, ect..

OLEA® LIB TARGET

Target Models of OLEA® FPCU Resources:
PWM, Timers , I/Os, ADC DPRAM, Triggers, ect..

System Features





Inverter Control

Complete inverter control for PMSM or WRSM motors based on field oriented control and space vector modulation algorithms.

All system functions include:

- MATLAB®/Simulink reference model
- MATLAB®/Simuling target model ready for code generation

DC-DC Converter Control

Buck-Boost Valley Current control function supporting up to 6 DC-DC converters in parallel.

- Configurable parameters via GUI
- Diagnostic functions

Top Algorithm Features

- Speed regulation with D/Q-Axis control PI regulators with Anti Wind-up
- DQ-axis Reference current computation
- Torque control with D/Q-Axis reference current computation
- Clarke Current: 3 to 2 phases or 6 to 2 phases current transformation
- Park Current: 2 phases current rotation from αβ to DQ framework
- DQ-axis Decoupling and flux weakening

- Inverse Park Voltage: DQ framework reference voltage transform into αβ voltage
- Space vector modulation
- IDQ regulation from torque set point
- Position and speed estimation based on Tracking-loop algorithm
- Position and speed estimation: for standstill, low-speed and high-speed operating modes
- Buck-Boost valley current control
- Voltage control

Math Features

Operator	Description		Exec. Cycles	# of Operators*
CORDIC (COordinate Rotation DIgital Computer)	• $x \cdot \cos(\theta) - y \cdot \sin(\theta)$ • $y \cdot \cos(\theta) + x \cdot \sin(\theta)$ • $\operatorname{atan}\left(\frac{y}{x}\right)$ • $\sqrt{x^2 + y^2}$	• $x \cdot \cosh(\theta) - y \sinh(\theta)$ • $y \cdot \cosh(\theta) + x \sinh(\theta)$ • $\operatorname{atanh}\left(\frac{y}{x}\right)$ *with* $\frac{y}{x} \in [-0{,}8{:}\ 0{,}8]$ • $\sqrt{x^2 - y^2}$ *with* $\frac{y}{x} \in$ [-0,8: 0,8]	Resolution in bit + 4	• 6 in parallel
Division	$A/B =$ *Quotient with remainder*		26	• 3 in parallel
Square root	• $\sqrt{R}$ *in unsigned mode* • $\sqrt{\lvert R \rvert}$ *in signed mode*		2	• 3 in parallel
Matrix Multiplier	• $\begin{bmatrix} r_0 \\ r_1 \end{bmatrix} = \begin{bmatrix} a_0 & a_1 & a_2 & a_3 & a_4 & a_5 \\ a_6 & a_7 & a_8 & a_9 & a_{10} & a_{11} \end{bmatrix} \times \begin{bmatrix} b_0 \\ b_1 \\ b_2 \\ b_3 \\ b_4 \\ b_5 \end{bmatrix}$	• $r_0 = \sum_{i=0}^{iter}(a_i \times b_i \gg Q_f)$ • $r_1 = \sum_{i=0}^{iter}(a_{i+6} \times b_i \gg Q_f)$	Iter + 4	• 3 in parallel
PID (Proportional Integral Derivative controller)	Saturation with Anti-windup: ▪ Back calculation : *if saturation then* $integral_n = K_i \times e_n - K_b\ (pid_{n-1} - pid\_sat_{n-1}) + integral_{n-1}$ ▪ Integral clamping : *if saturation and sign(*pid_{n-1}*)=sign(*e_{n-1}*) then* $integral_n = integral_{n-1}$		8	• 6 in parallel

*OLEA® LIB Math is using hardware dedicated resources available in OLEA®

www.silicon-mobility.com
sales@silicon-mobility.com
535 Route des Lucioles
Les Aqueducs – Bâtiment 2
06560 Sophia Antipolis
France

Legal Disclaimer: the information given in this Brief shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Silicon Mobility hereby disclaims any and all warranties and liabilities of any kind, including without limitation, warranties of non-infringement of intellectual property rights of any third party.