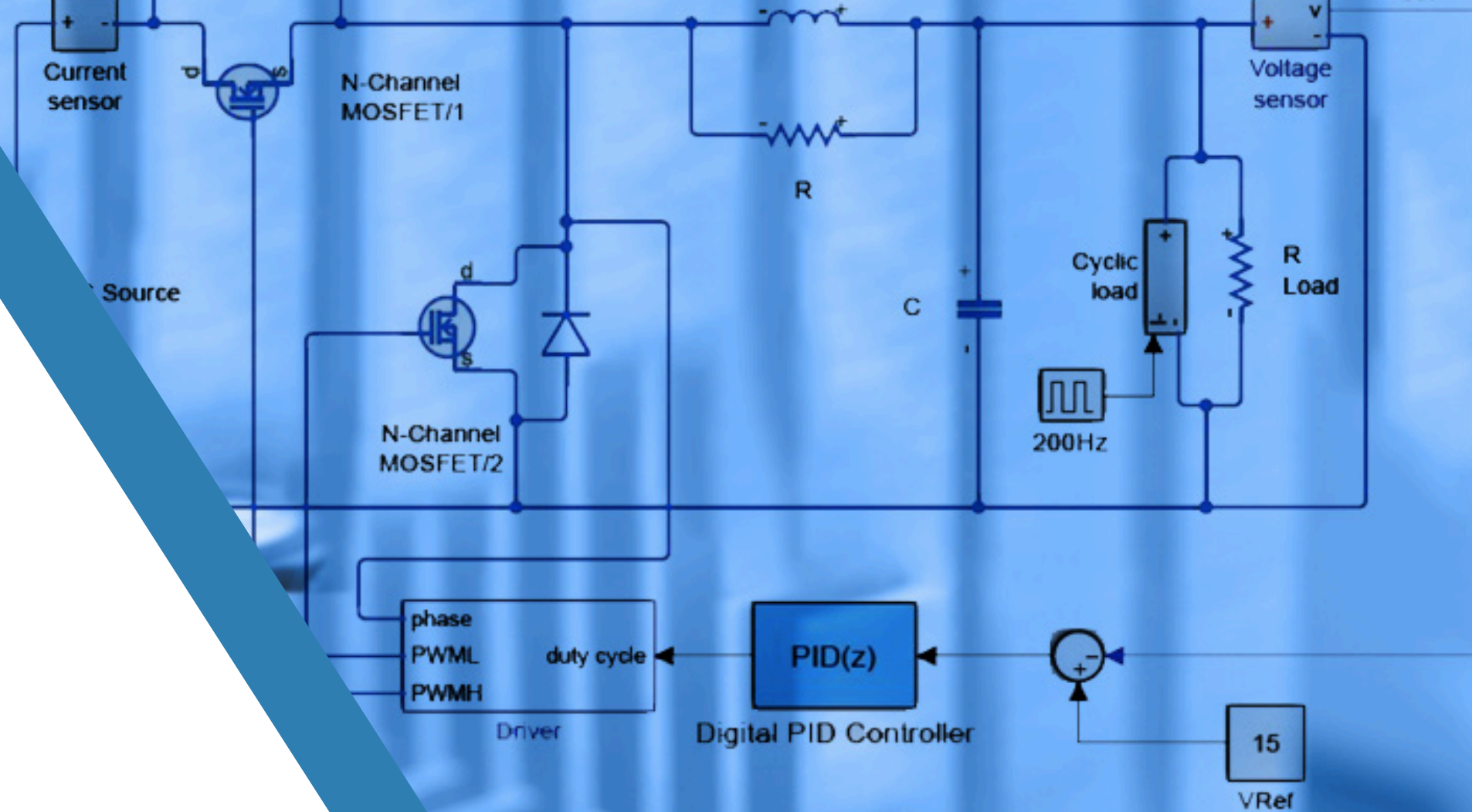# MathWorks®

Designing Efficient Power Electronics Converters with MATLAB and Simulink

Overview

Power electronics are critical to enabling a range of new and evolving technologies, including electric grids that use renewable energy, electric vehicles for clean transportation, and variable-speed motors for industrial applications.

When designing efficient power electronics systems, key challenges include:

- Reducing the size of components and losses in power electronics converters
- Designing feedback control and supervisory logic to improve power quality
- Accelerating the use of digital controls for power electronics

This ebook explores how you can address these complex challenges using MATLAB® and Simulink®.
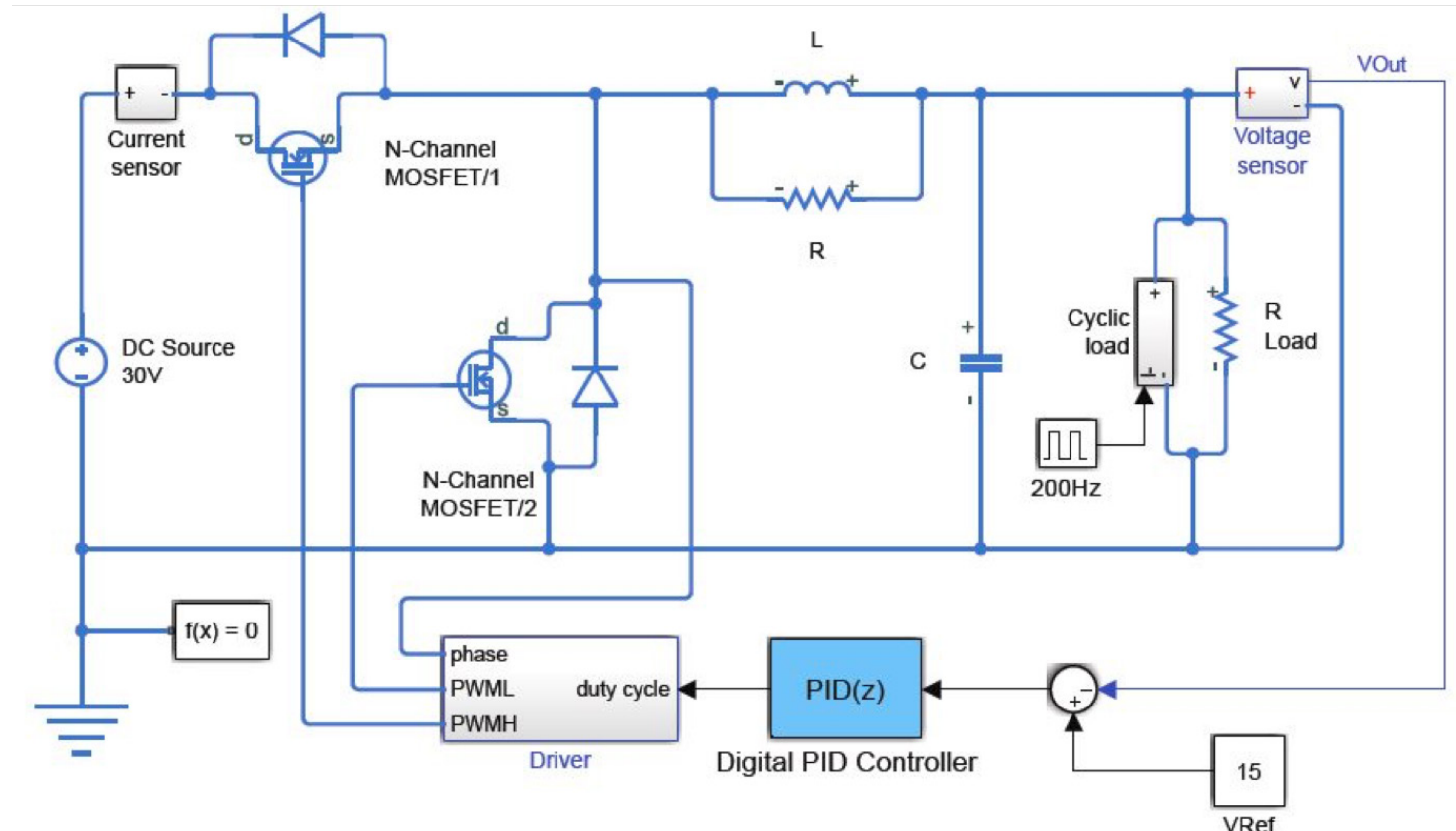
Reducing the Size of Components and Losses in Power Electronics Converters

With MATLAB, Simulink, and Simscape™, you can model power electronics systems, reduce component size, and determine losses by:

- Quickly modeling multidomain systems using built-in library blocks
- Using simulation to size active and passive elements of your design
- Determining losses and simulating faults in power electronics converters

Learn More

» *Loss Calculation in a Three-Phase 3-Level Inverter* (Example)
» *Buck Converter with Faults* (Example)
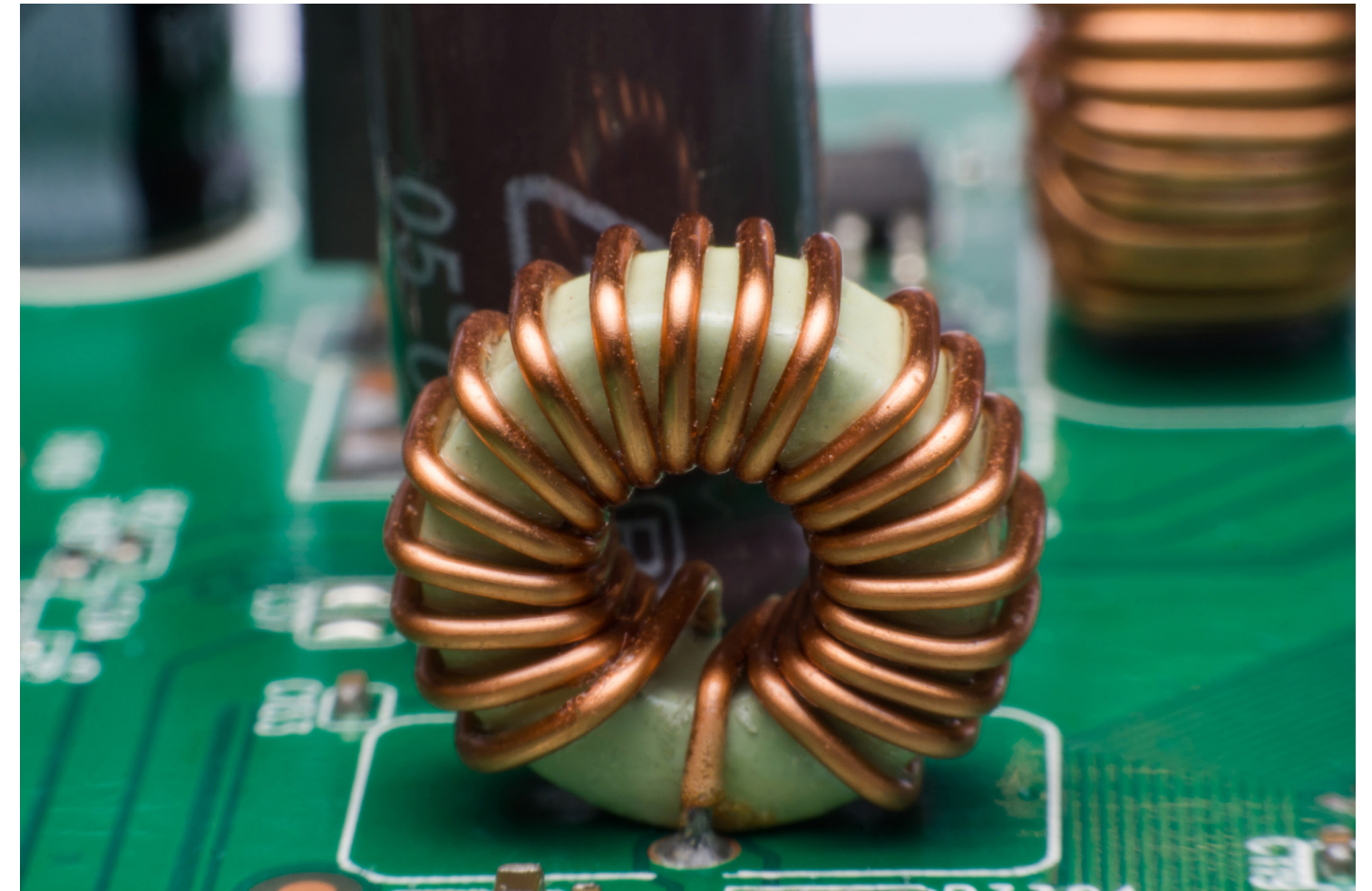
With Model-Based Design we saw exactly how our controller would work with the hardware even while the hardware was being developed. After we had the hardware, refinements were easy because the simulations matched what we saw on the scope, and that gave us tremendous confidence in the design.

– David Erhart, *Stem*

Designing Feedback Control and Supervisory Logic to Improve Power Quality

Power electronics controls engineers can gain an understanding of the interaction of digital control algorithms and power electronics converters by:

- Linearizing and designing the feedback controller of switching converters
- Validating the control algorithm as well as supervisory logic through closed-loop simulation

Learn More

» *Field-Oriented Control of Permanent Magnet Synchronous Machine* (Example)
» *PID Controller Tuning for a Buck Converter* (6:32)

We completed controller development in about four months. Without Model-Based Design it would have taken at least twice as long, because we would have had to wait for hardware, write code by hand, and test more prototypes.

– Michael Schwarz, *ITK Engineering*
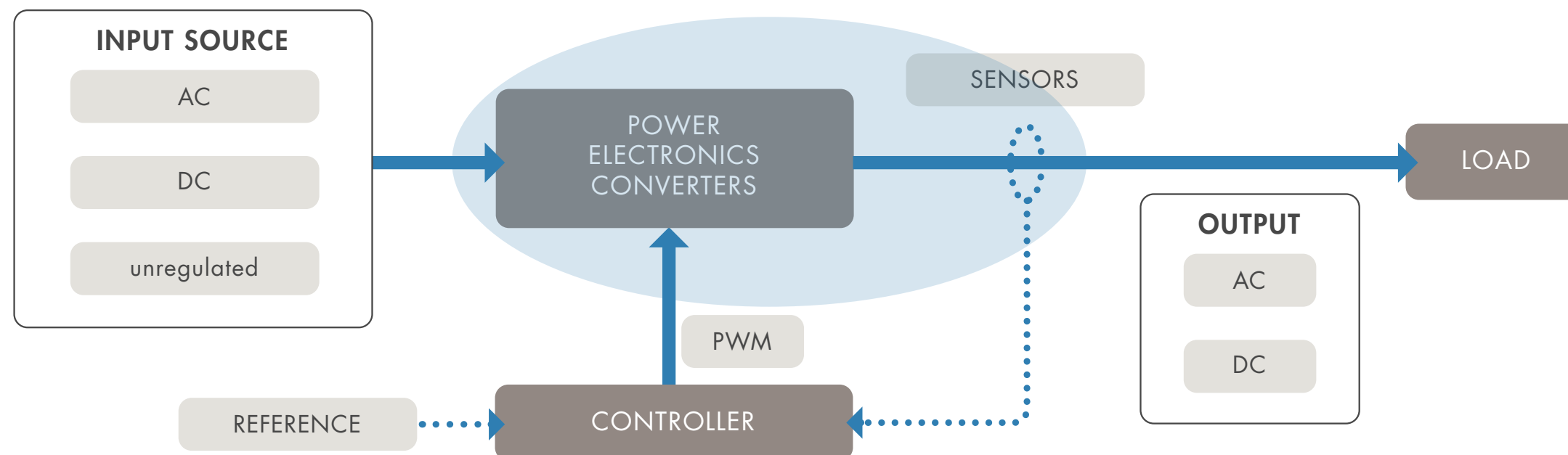
Accelerating the Use of Digital Controls for Power Electronics

Software engineers can reduce the development time and prevent defects in the later stages of development cycle by:

- Verifying the functionality of the controller for various test scenarios
- Generating code from MATLAB and Simulink algorithms optimized for embedded controllers

Learn More

» *Generate Embedded Code for Field-Oriented Control Algorithm* (Example)
» *Generate HDL Code for Field-Oriented Control Algorithm* (Example)

MathWorks products considerably reduced application control software development time for the new AC 800PEC controller in comparison with the controller's predecessor. The code generated from the Simulink models can be used directly in the controller, eliminating the need for a separate, costly implementation phase.

– Fritz Wittwer, *ABB*
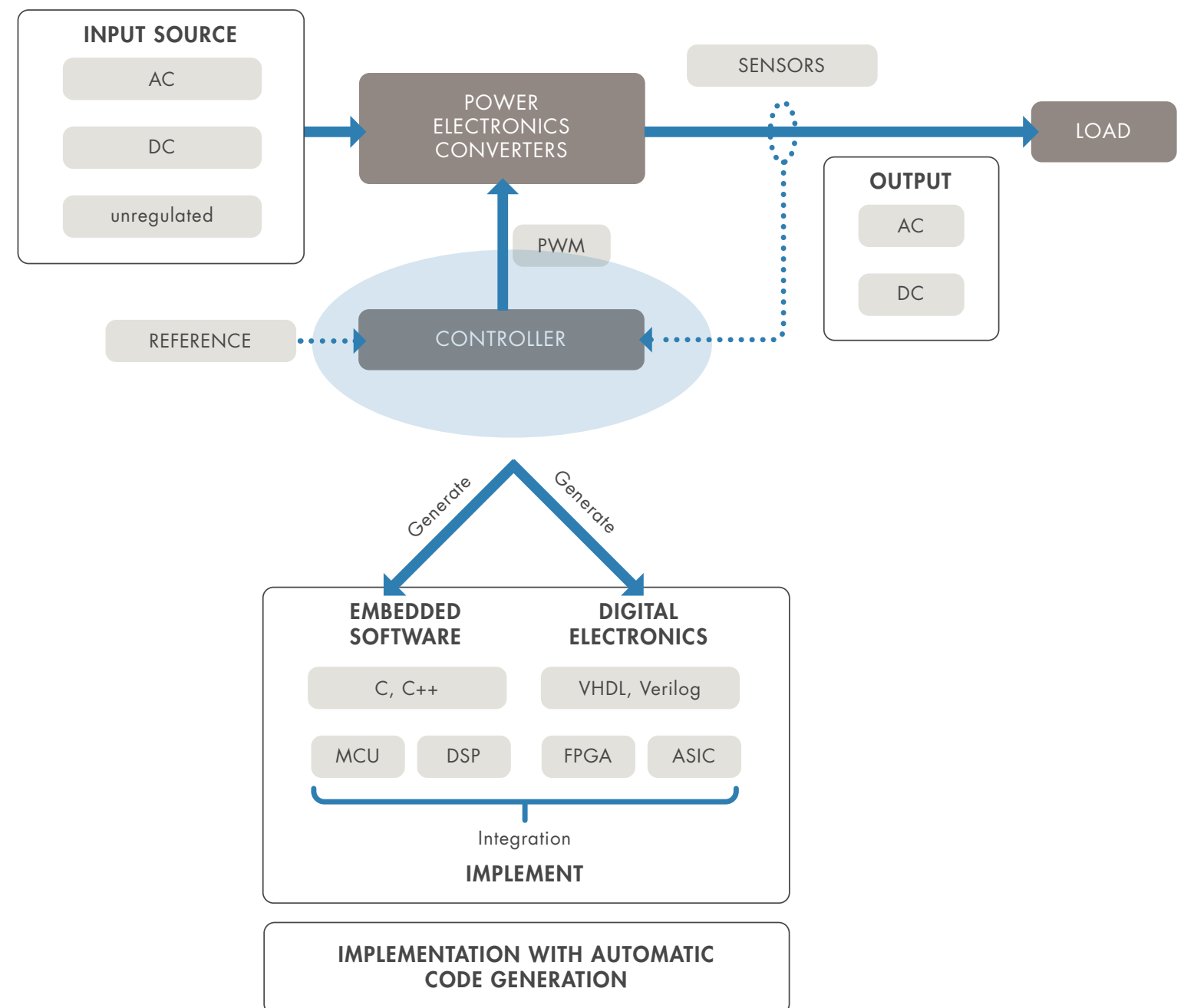
Get Started

Download a trial:

Software for Motor and Power Control System Design

Watch video:

Hardware-in-the-Loop (HIL) Testing for Power Electronics Systems Modeled in Simulink (34:20)

Read white paper:

10 Ways to Speed Up Power Conversion Control Design with Simulink