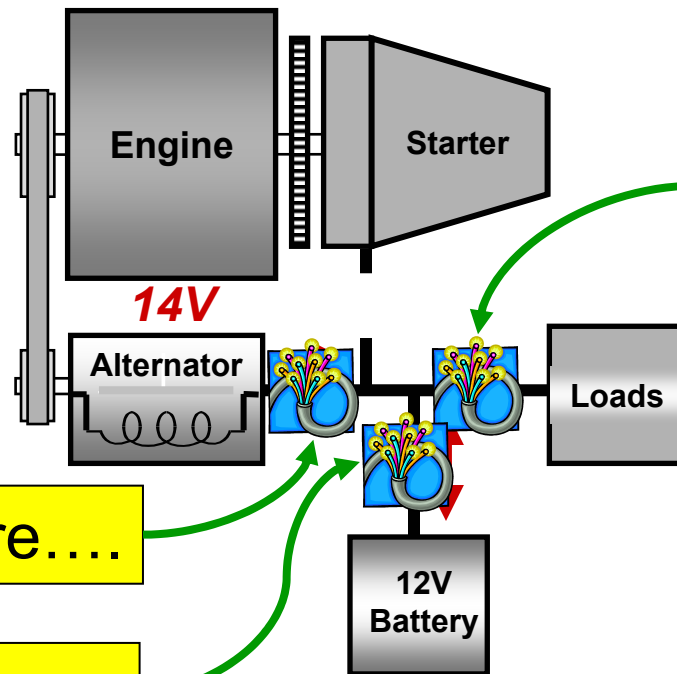


Load Dump Analysis

Ansoft Corporation
Pittsburgh, PA

14 V Single Battery System



...or here.

OPENs occur here....

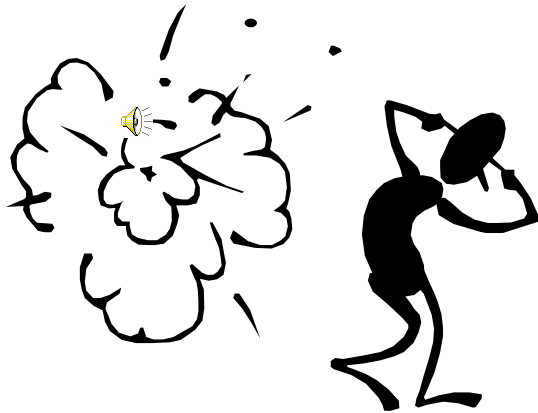
...or here...

- WHY?**
- Cables corrode and break
 - Nuts & bolts come loose
 - Mechanics disconnect the wrong wire at the wrong time.

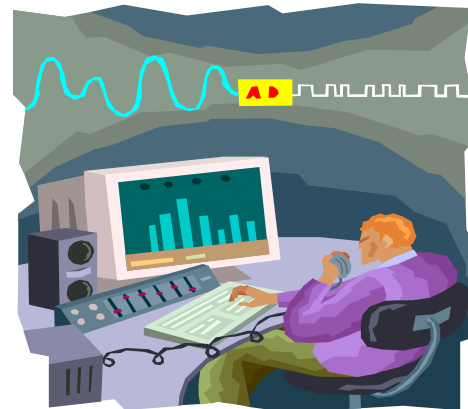
2-3 kW power generation capability

Instances

A major OEM received six new 42 volt alternators from a supplier. Three were destroyed in testing during the first month. That's \$15,000 up in smoke. They bought SIMPLORER.



Another major OEM worked for over a year to create an accurate Saber alternator model that could be fit to parametric data. They have not succeeded. Ansoft and the OEM are discussing the deployment of SIMPLORER.

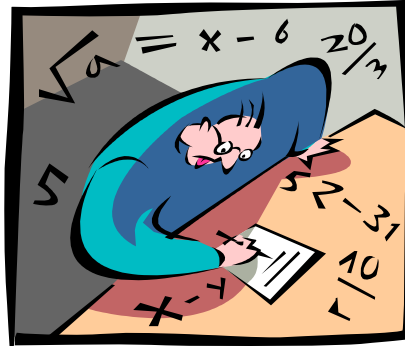


Why should you be interested?

Solving “by hand”

Time consuming

Error prone



Options are few!

Testing

Destroy or degrade parts

Very difficult to repeat

Insufficient quantity of parts available



Simulation

Parts are virtual...don't “smoke”

Exactly repeatable



All are necessary to some extent and support one another.

Ansoft's Solution

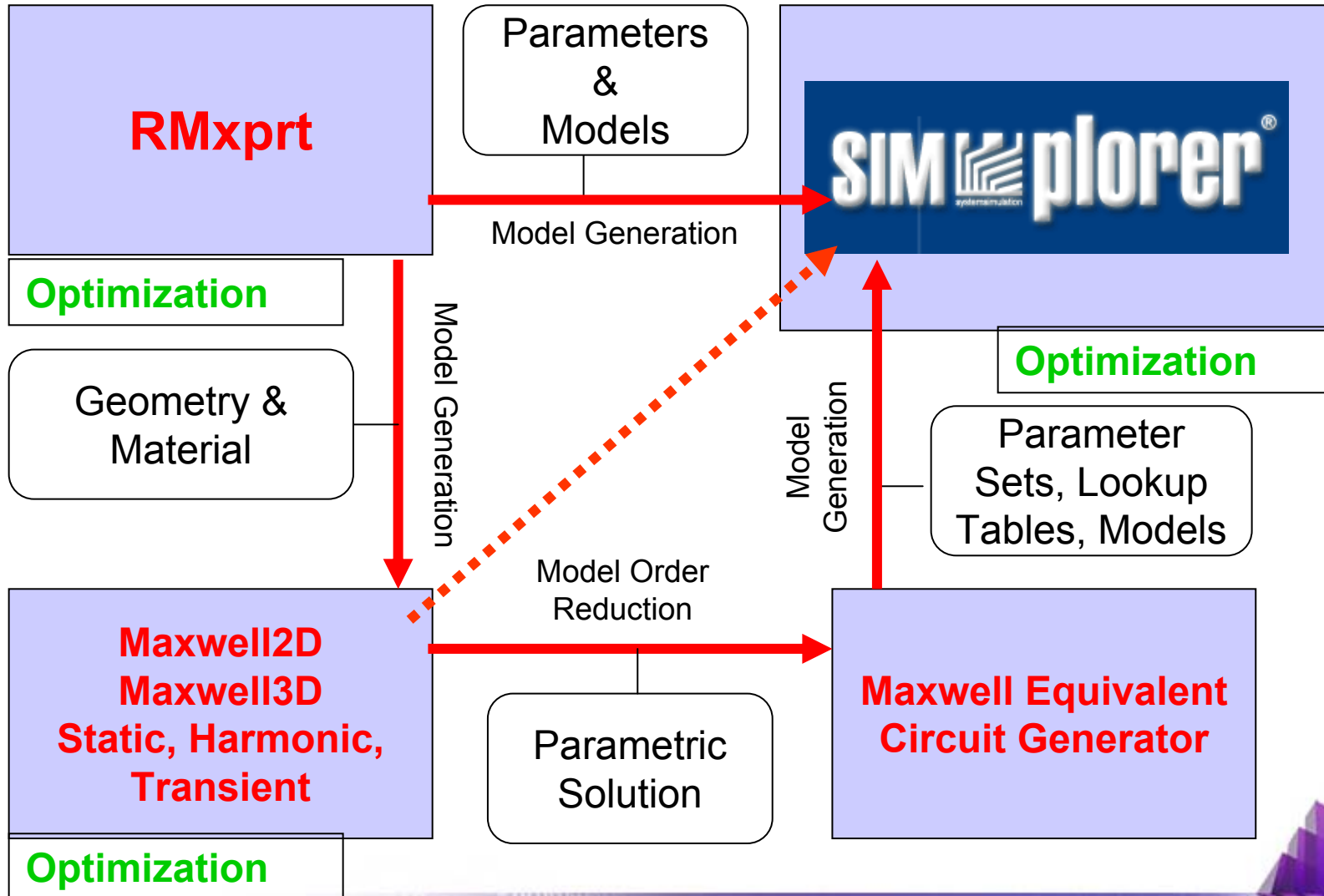
- ▶ RMxpert

- ▶ Motor/generator design tool that can automatically produce a model for SIMPLORER

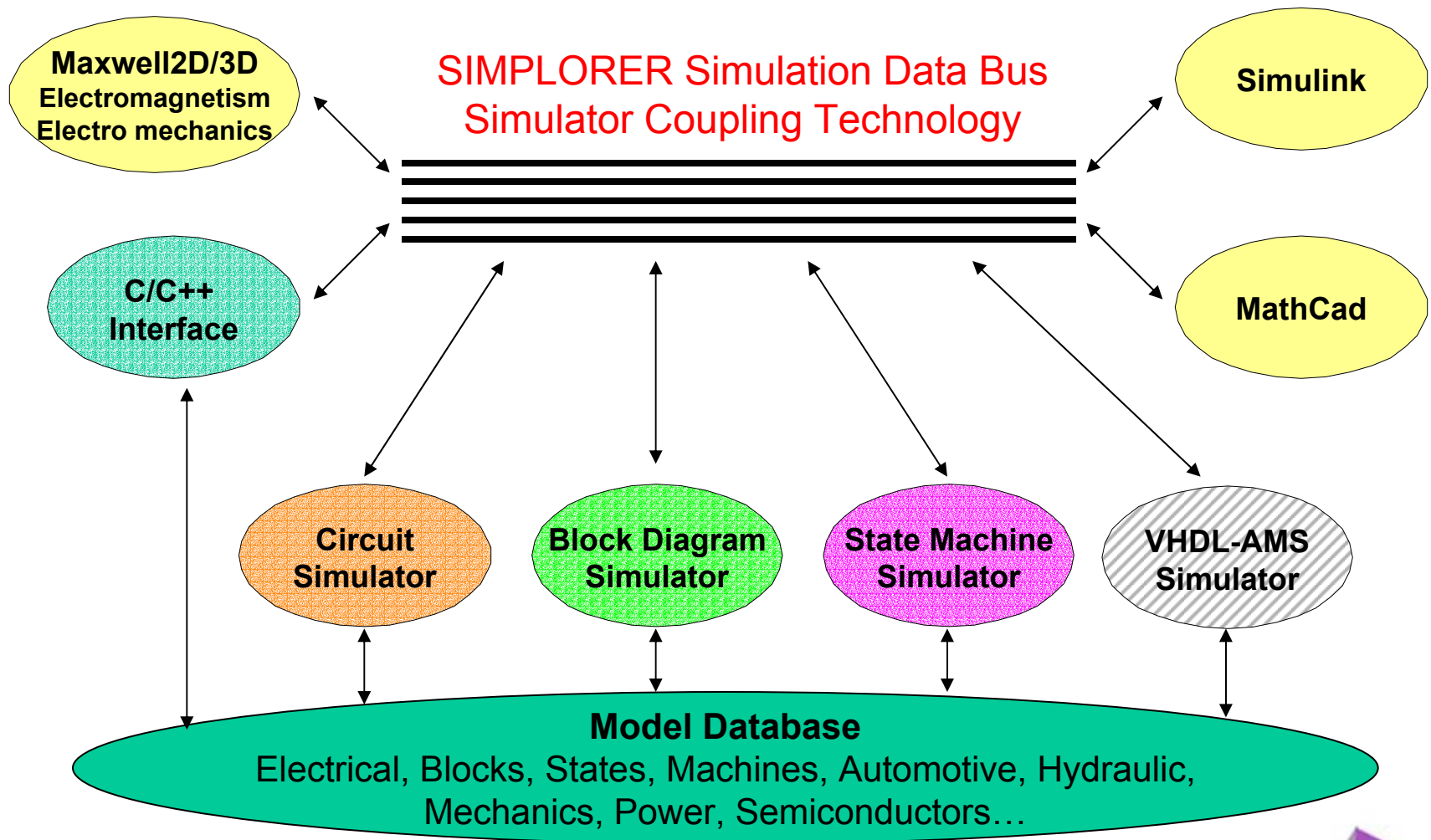
- ▶ SIMPLORER

- ▶ simulate the alternator, the battery, the loads and the devices and strategies that control and regulate the alternator

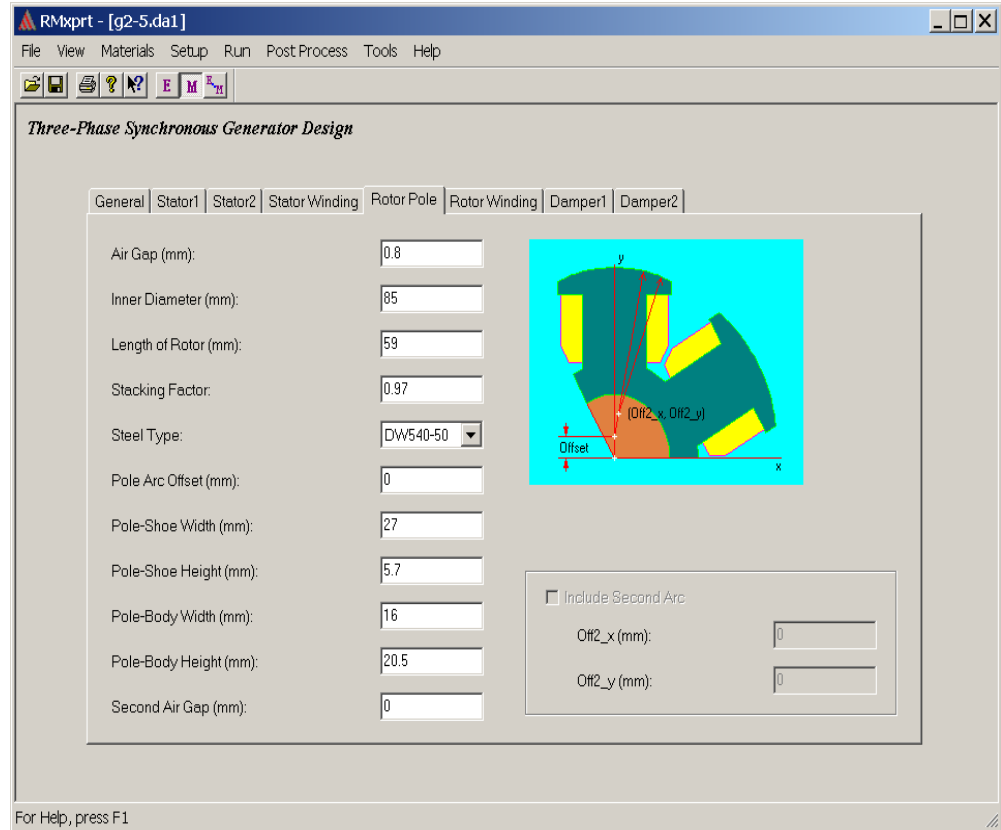
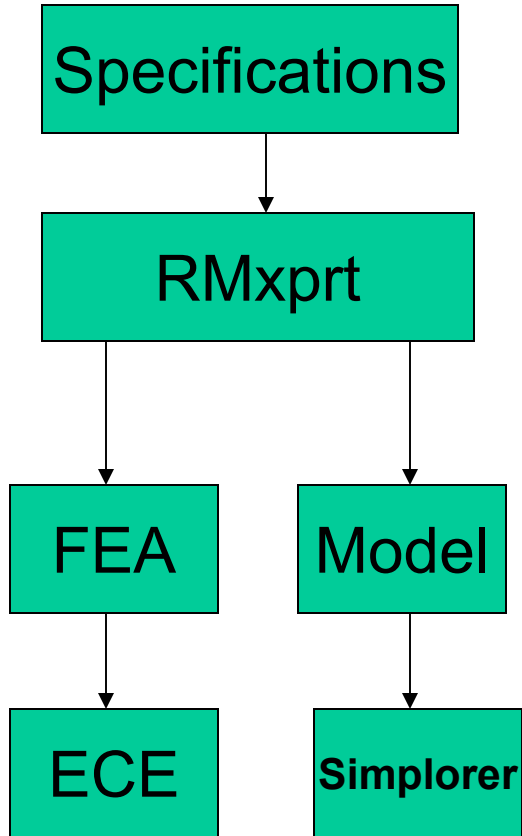
Design Flow



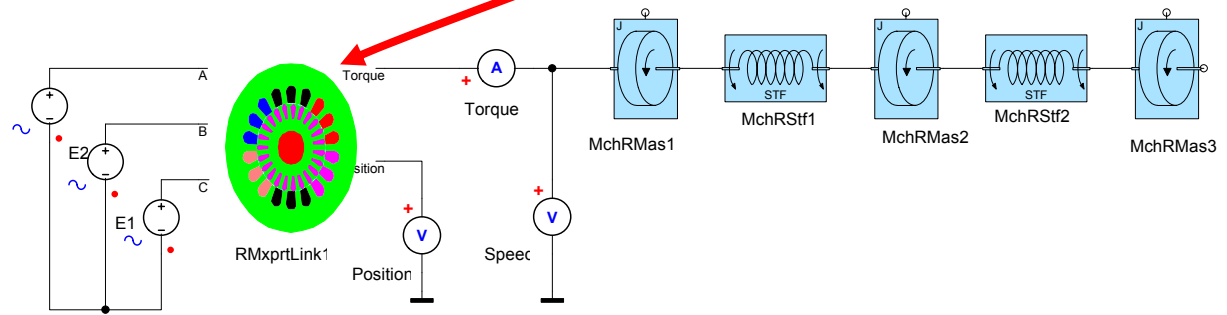
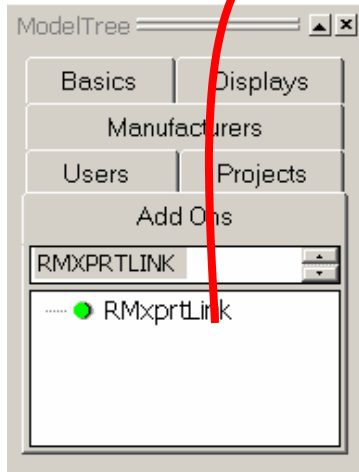
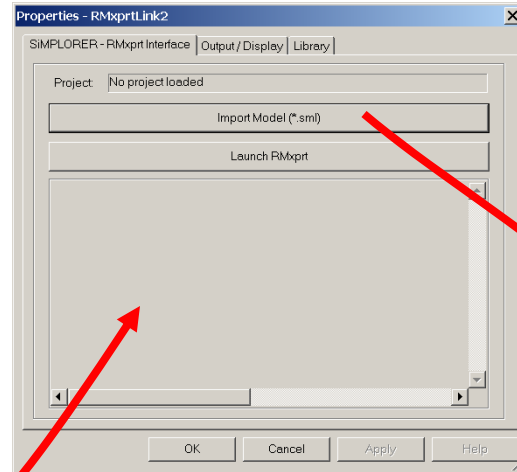
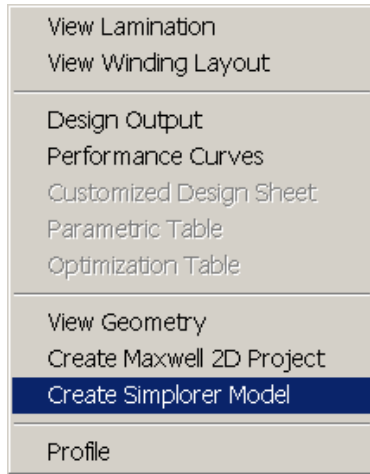
Multi Domain Simulation



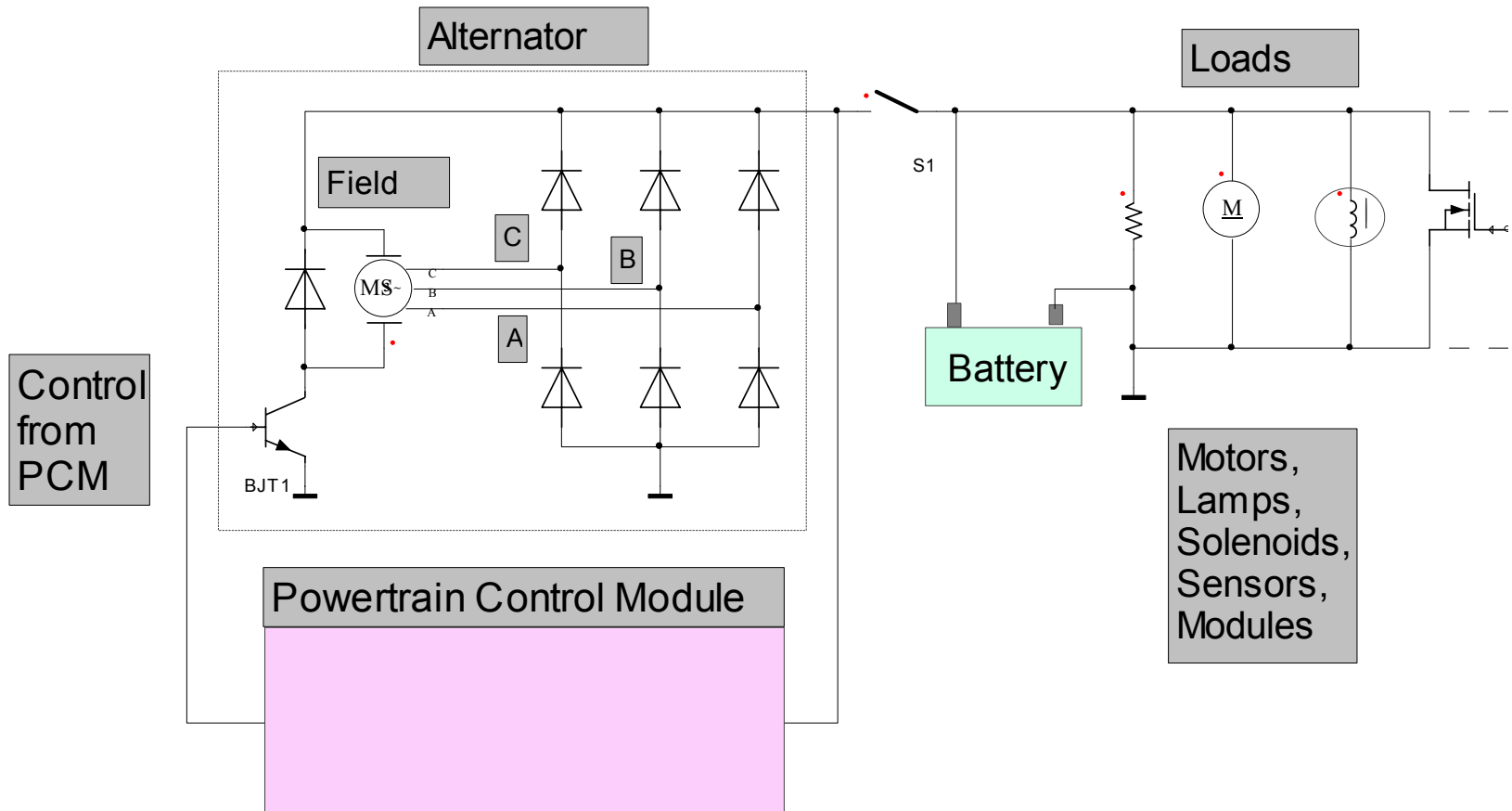
RMxpprt Data Input



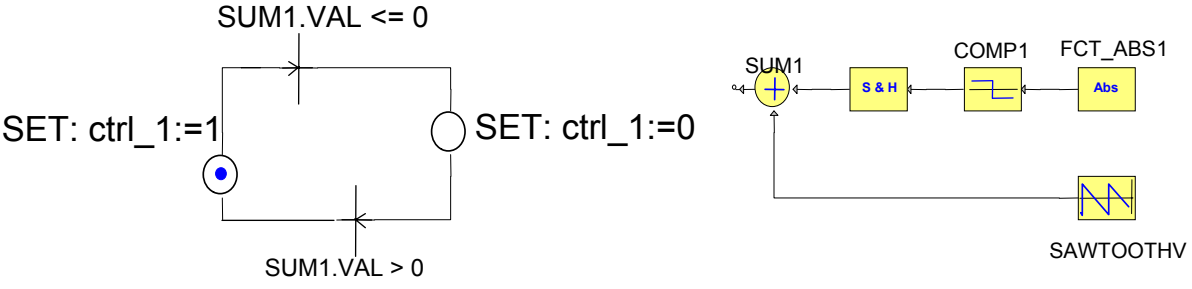
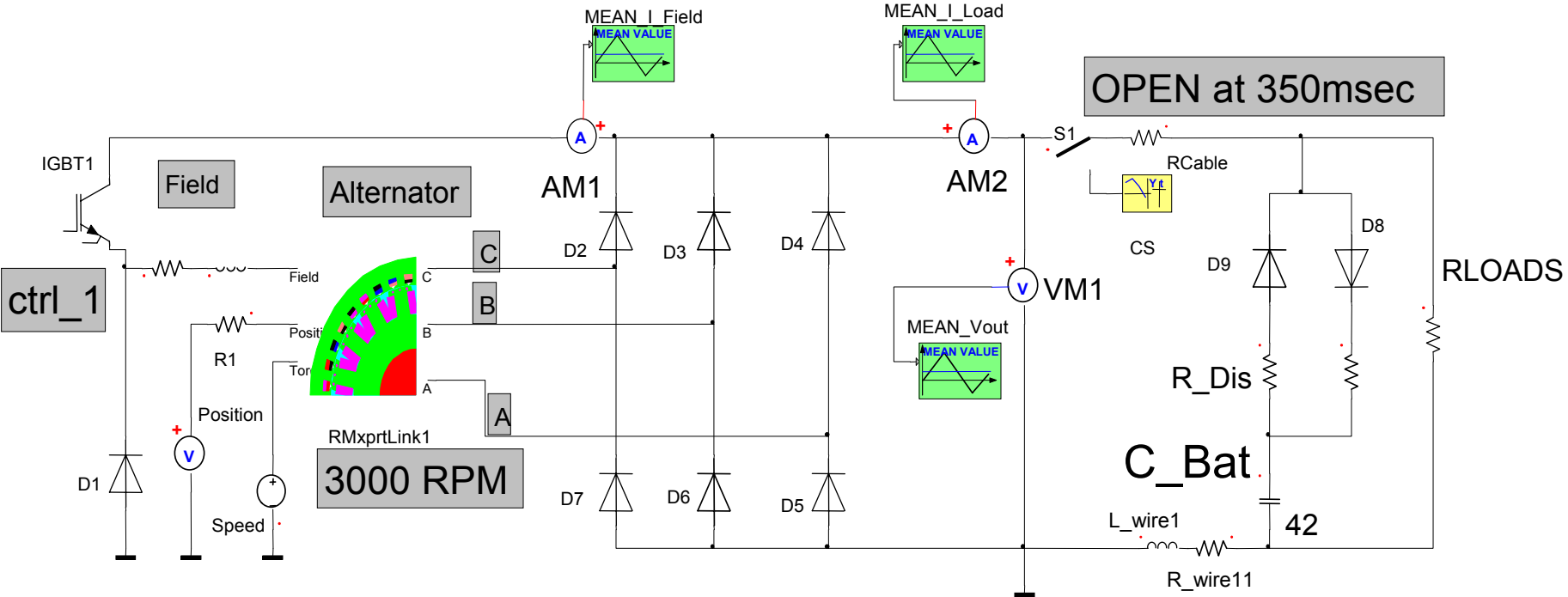
RMxpert -> SIMPLORER



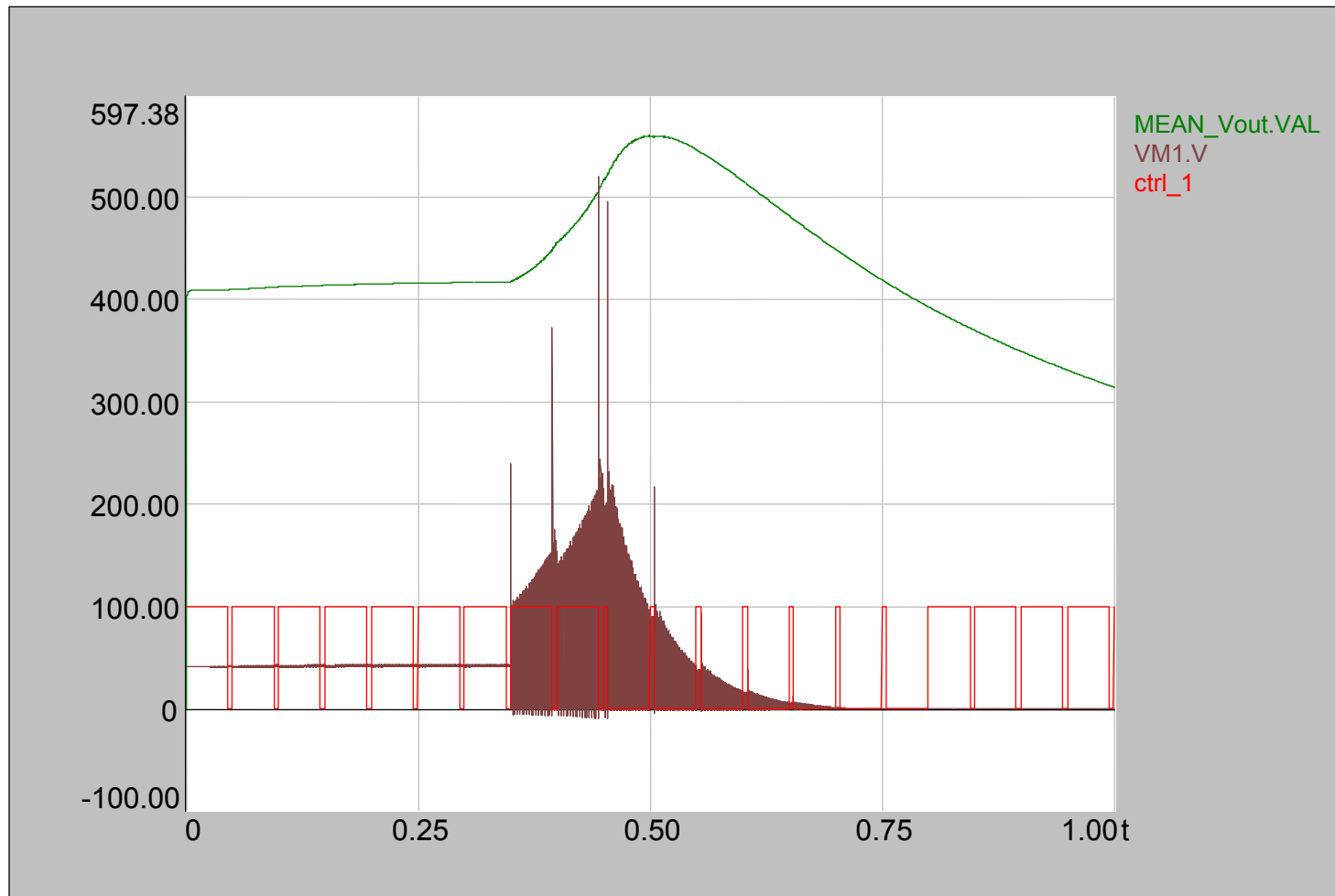
Typical Charging System: Alternator, PCM, Battery, Loads



Charging System in SIMPLORER

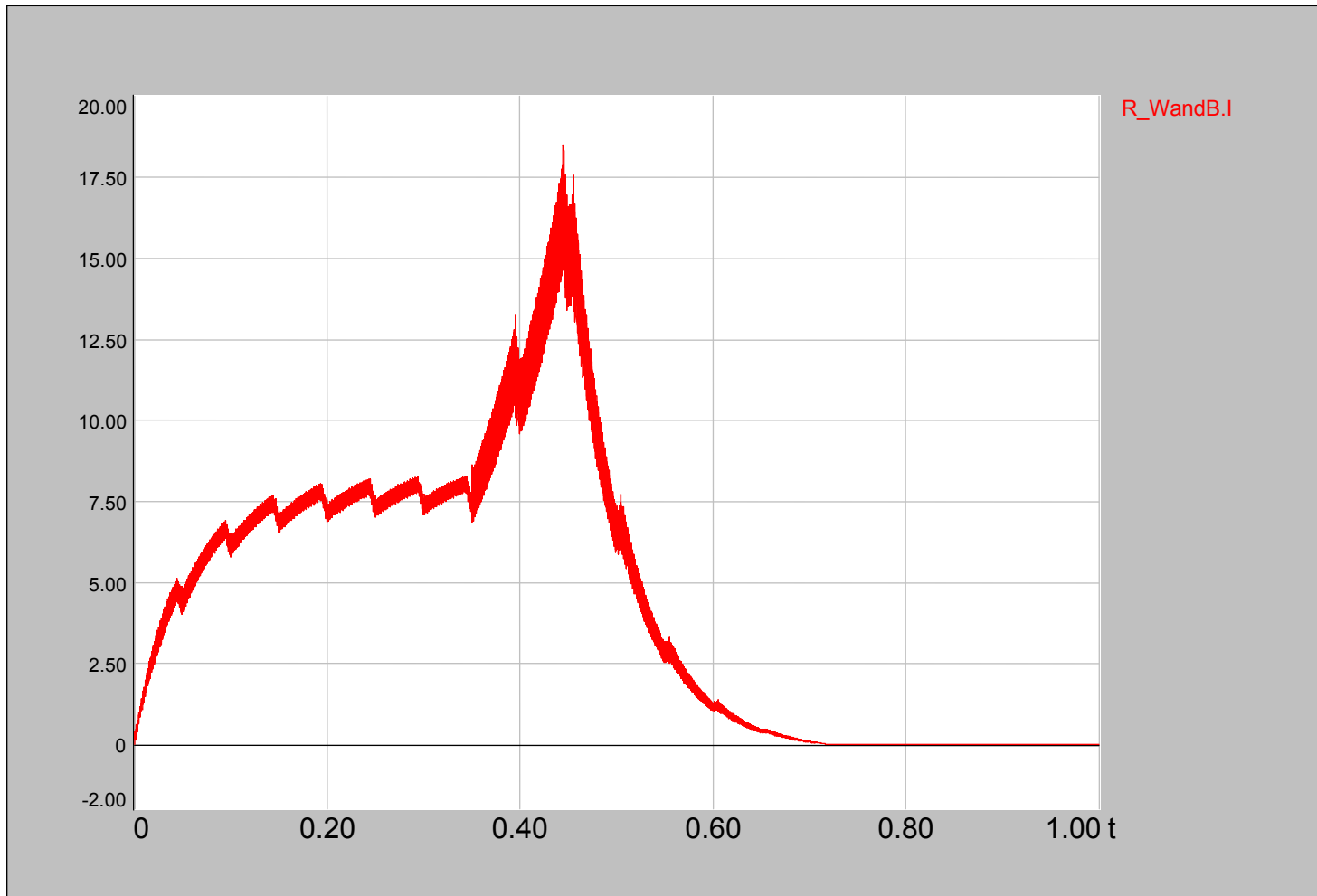


Simulation Results



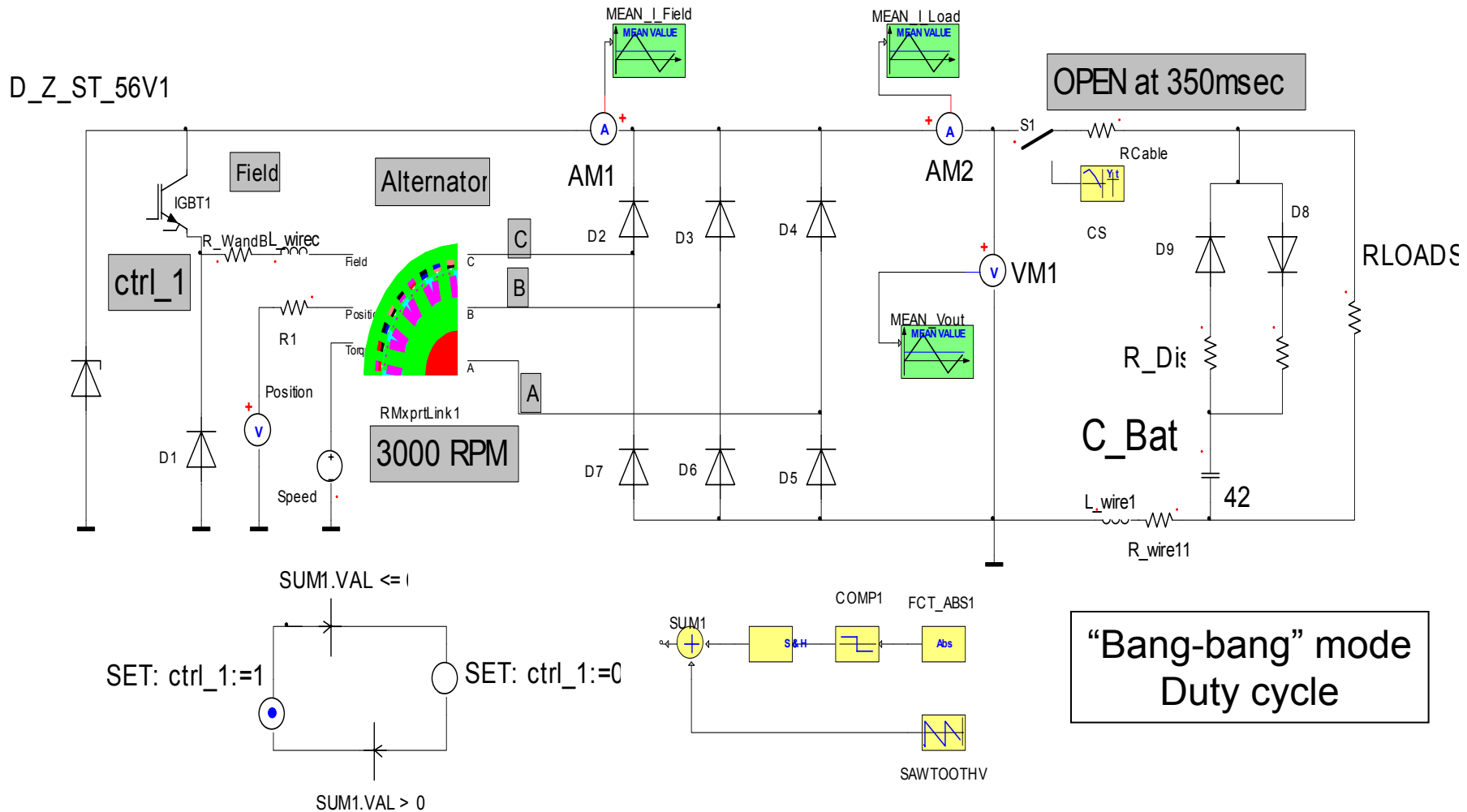
Output Voltage, Average Output(X10), and Control Signal(X100)

Simulation Results



Field Current

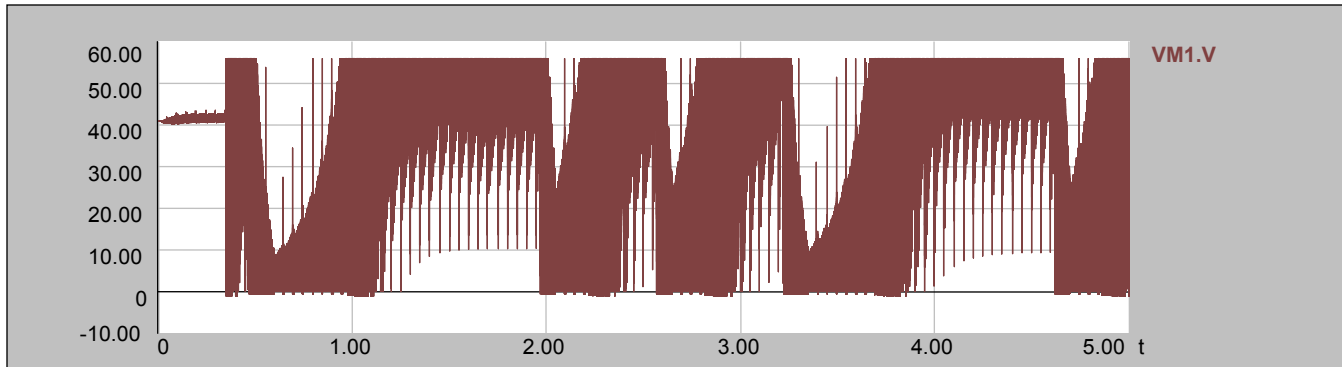
Design Improvement



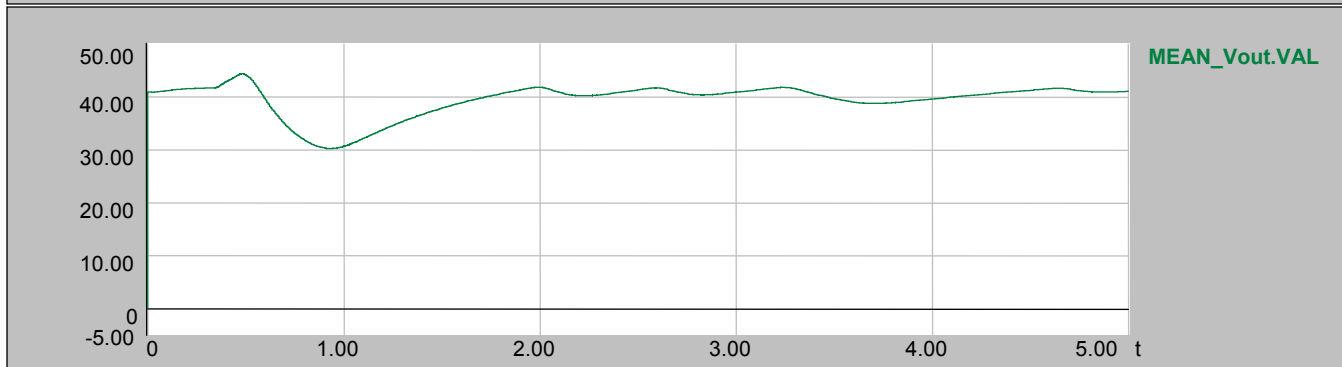
“Bang-bang” mode
Duty cycle

Add zener, adjust sawtooth frequency & duty cycle

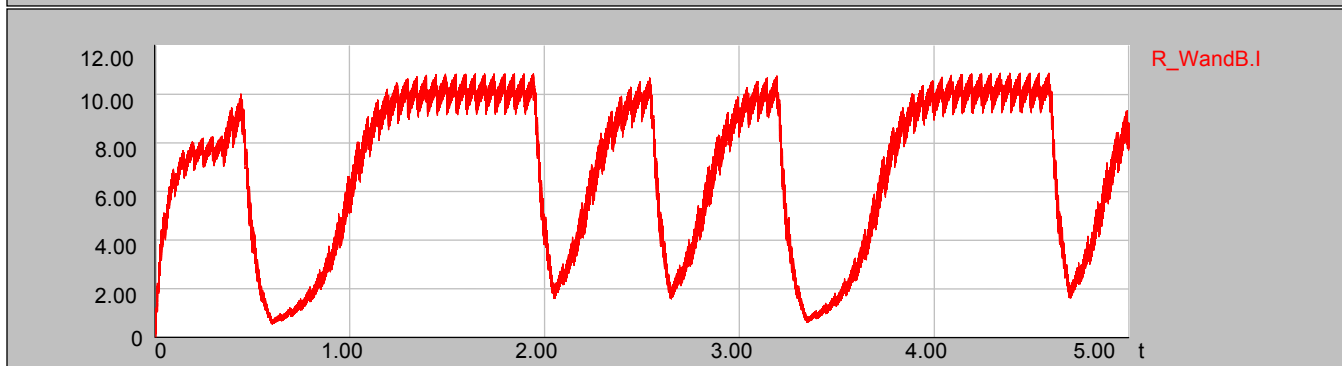
20Hz Sampling with 90/10 PWM



**Output
Voltage**

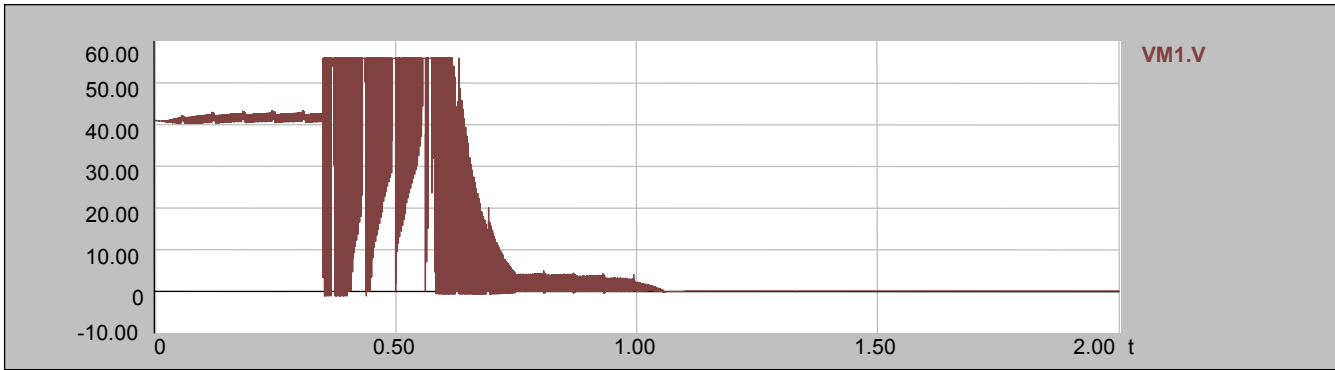


**Average
Output
Voltage**

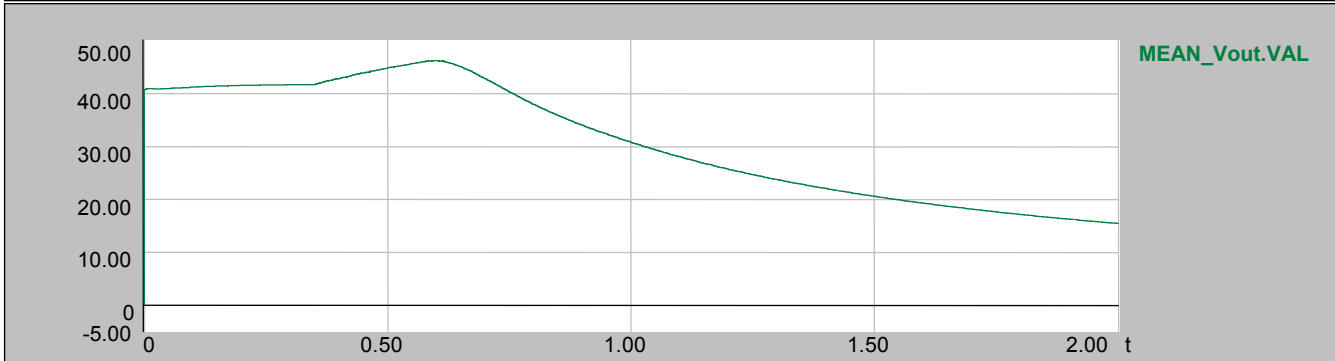


**Field
Current**

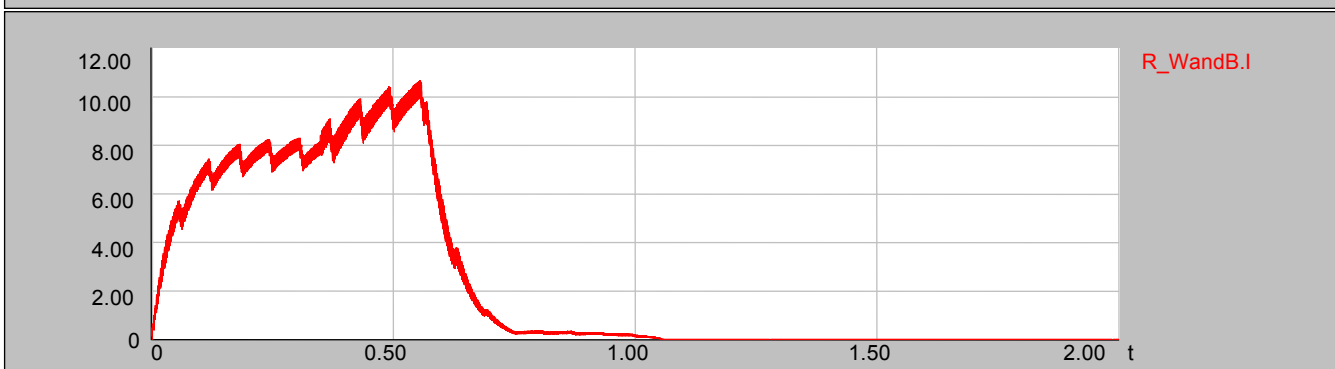
16Hz Sampling with 90/10 PWM



**Output
Voltage**



**Average
Output
Voltage**



**Field
Current**

Summary

RMxpert and SIMPLORER enable the engineer to study all the design alternatives quickly and without destroying or degrading the properties of valuable components. With this information highly focused testing can be carried out to complete the development process.

Benefits:

- ✓ Shortened development time
- ✓ Improved performance and reliability
- ✓ Greater customer satisfaction
- ✓ Lower warranty costs