USER CONFERENCE Graser 2014 Oct 31 Taipei

Designing Power Electronics

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31/Oct/2014

Graser

Power Electronic Designing Vision

Miniaturization

2010s

2000s

1990s

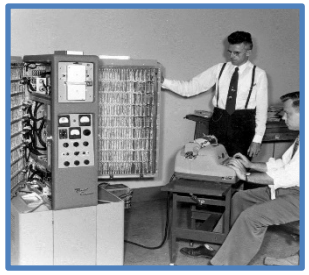
1980s

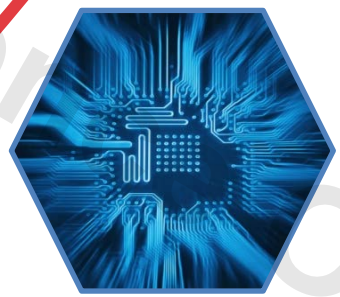
1970s

1960s

Nano Technology

SILICON CAPACITY

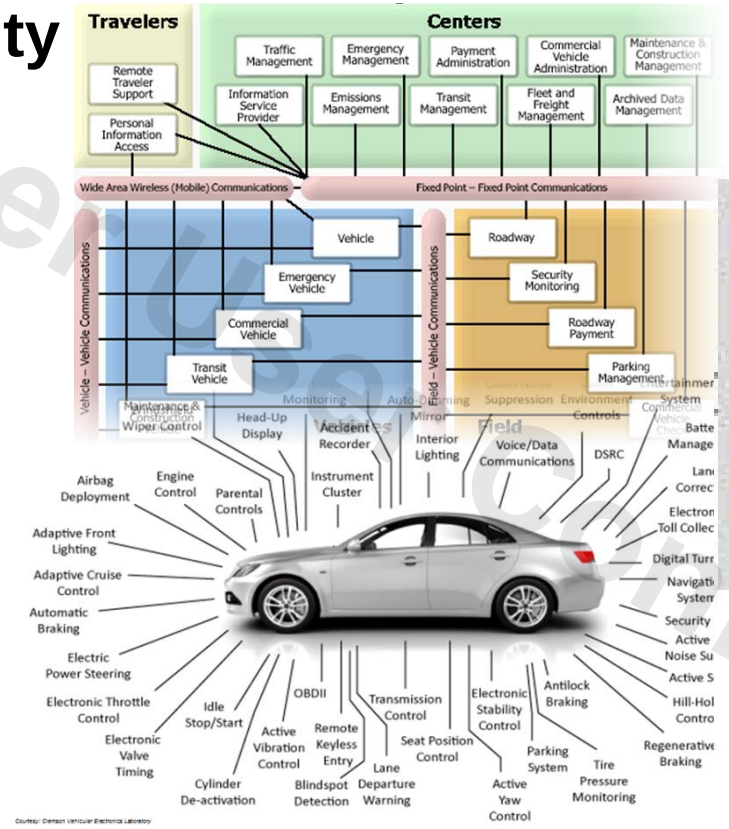




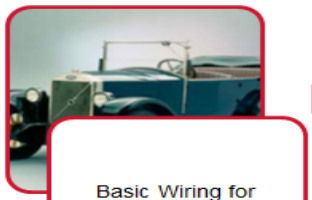
Technology

Miniaturization

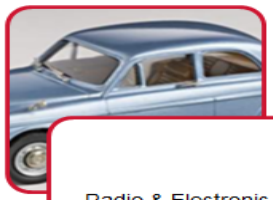
Complexity



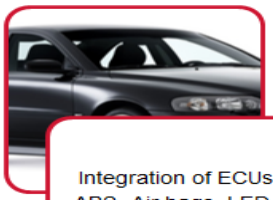
- Systems Modeling
- ECU Logic Authoring
- Power Electronics
- Multi-Domain Mixed Signal Control Systems
- Sensors
- Network Enabled
- Embedded Software



Basic Wiring for Headlights and Ignition



Radio & Electronic Ignition



Integration of ECUs
ABS, Air bags, LED, Electronic Gear Box, Navigation

Interaction with Environment
Proliferation of ECUs
Telematics, Bluetooth, Internet,
Drive-by-Wire,
Hybrid Drives

Medical Electronics

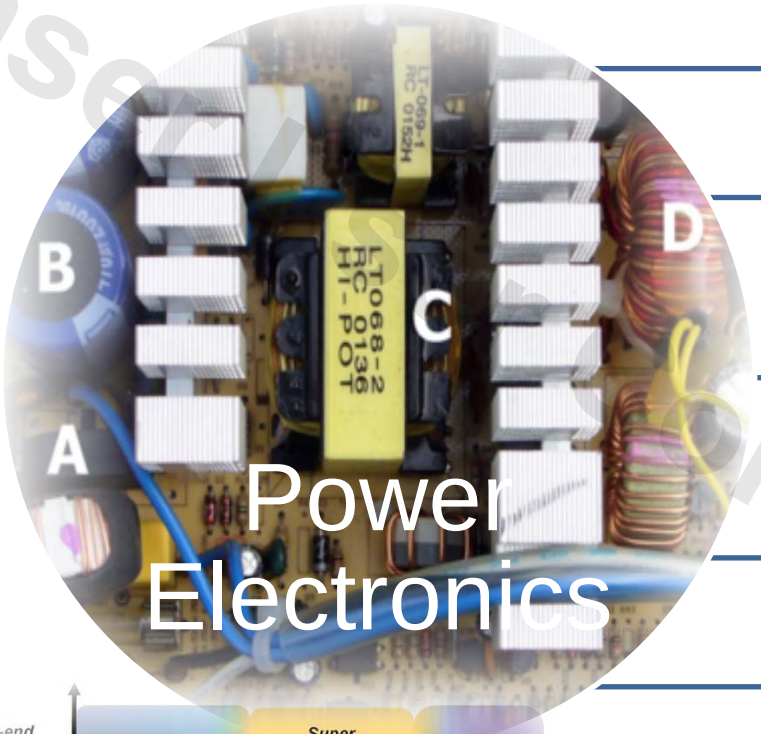
Complexity

Trending in Portable Imaging Monitoring

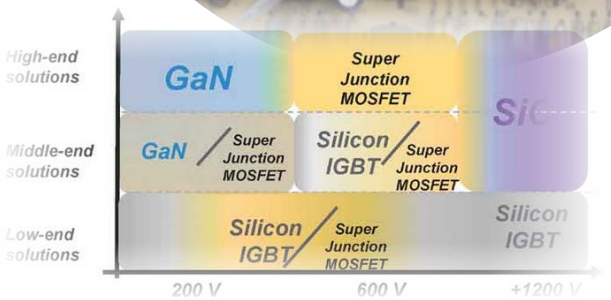
Growth Factors:
Elderly Population & Emerging Markets

Power Electronics

A Common Denominator



- Computing
- Automotive
- Medical
- IoT
- Consumer Electronics



New Device Technology

Source :UK Power Electronics report and Electronic Design

Design Challenges

1. Green Power Design

2. Energy storage issue

3. Energy conversion efficiency

4. Power Management

5. Analog Device Interface

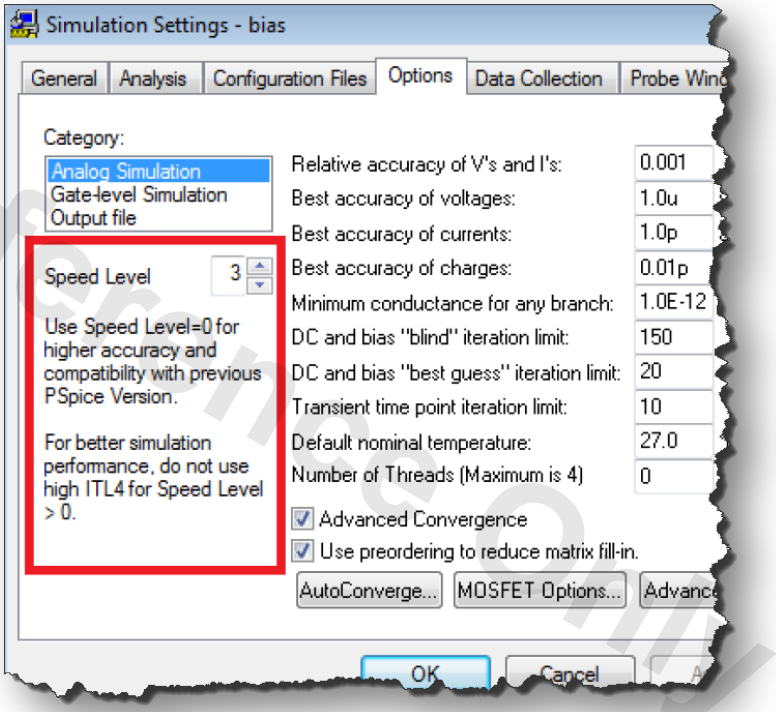
PSpice Enhancement

- Power Electronic Designing Vision
- Performance Upgrade
- Model Support Enhancement
- Features Enhancement
- IBIS model support to V5.0

Performance Improvements

Speed Upgrades

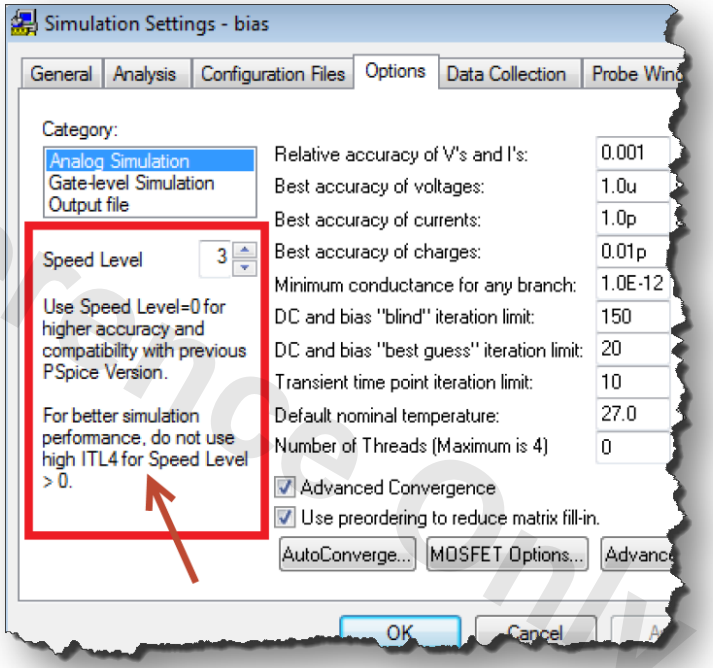
- 5 levels of speed upgrades
  - Default speed level is 3
  - Speed level 0 should be set for compatibility with previous releases
- Removed multi-core usage limit and default multi-thread usage
  - Previous releases used 50% of the available threads up to 4 cores
- Speed level allows faster switching of devices and shows substantial improvement
  - In test cases with switches, more than a 5x performance improvement has been measured at level 3



Performance Improvements

Convergence Improvements

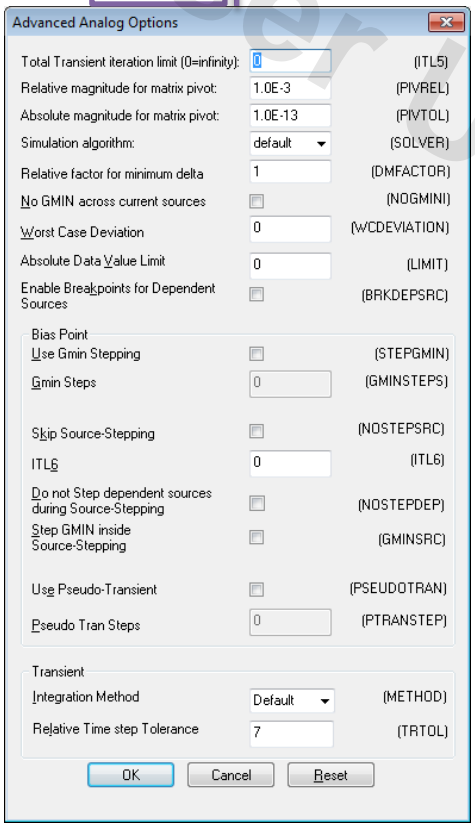
- Previous release required a high ITL4 values when using Switches circuits to achieve convergence
  - At low ITL4 values, convergence errors were observed
  - At high ITL4 values, performance and mathematic errors were frequently observed
- With QIR7 improvements, it is recommended to use lower values of ITL4 to achieve convergence and performance
  - Note: using SPEED_LEVEL=0 will require high ITL4 values to converge



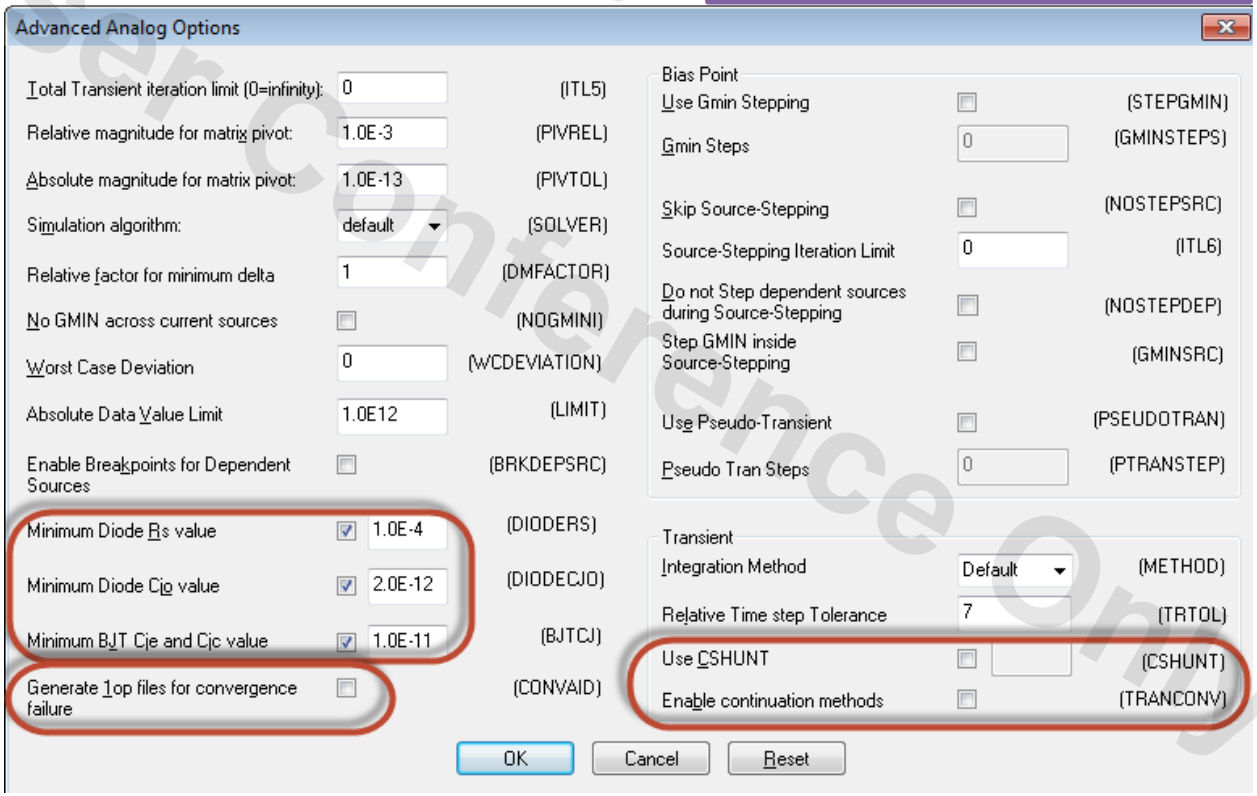
Performance Improvements

New Convergence Options

16.6



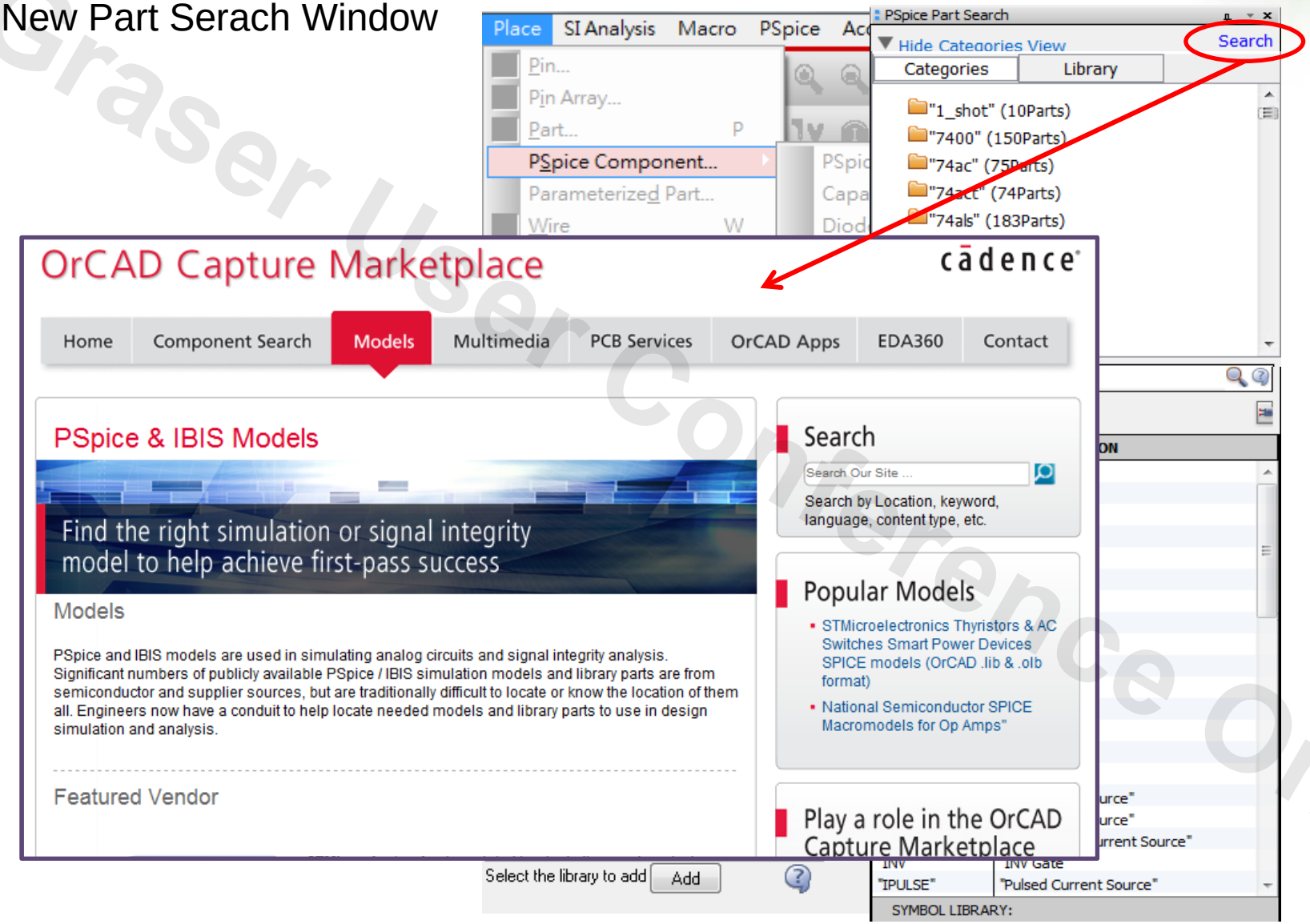
16.6 with QIR Update 3



Features Enhancement

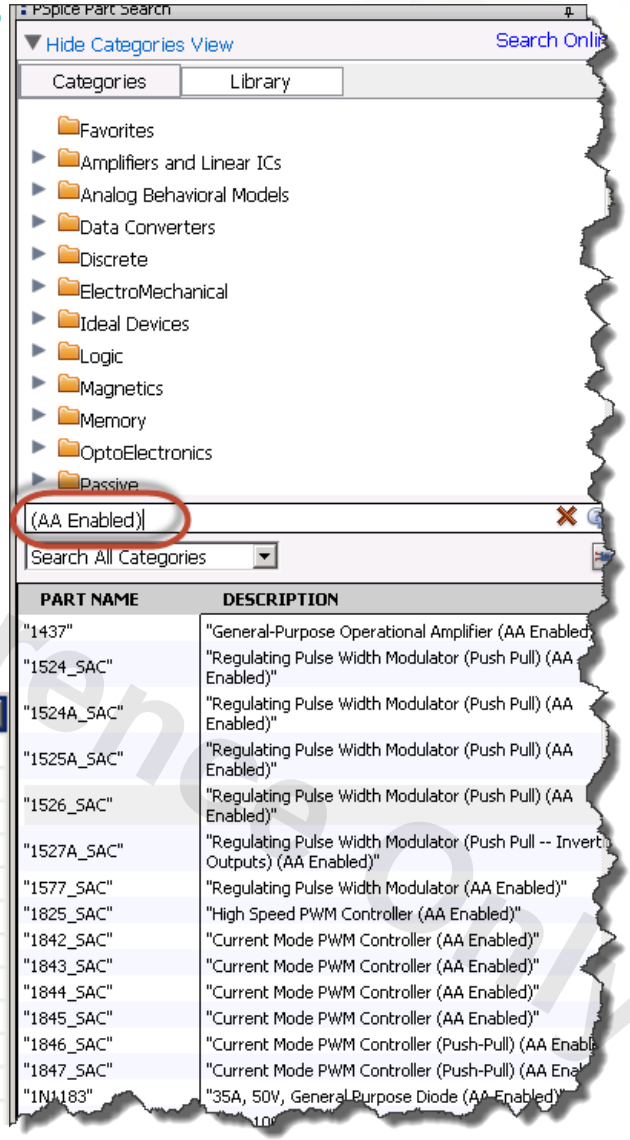
New Model Search

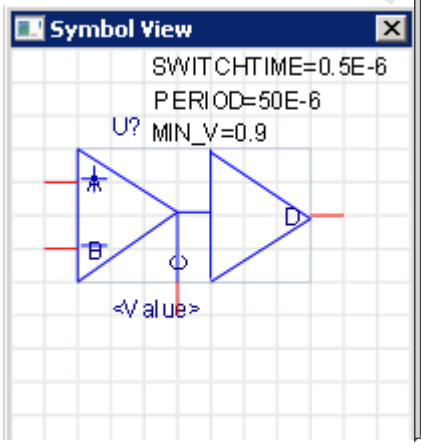
New Part Serach Window



PSpice Search – Advanced Analysis Parts

- Advanced Analysis Parts are now available through PSpice Searcher
  - Use search string ‘A/A Enabled’ to find all A/A parts
- Searcher symbol viewer updated



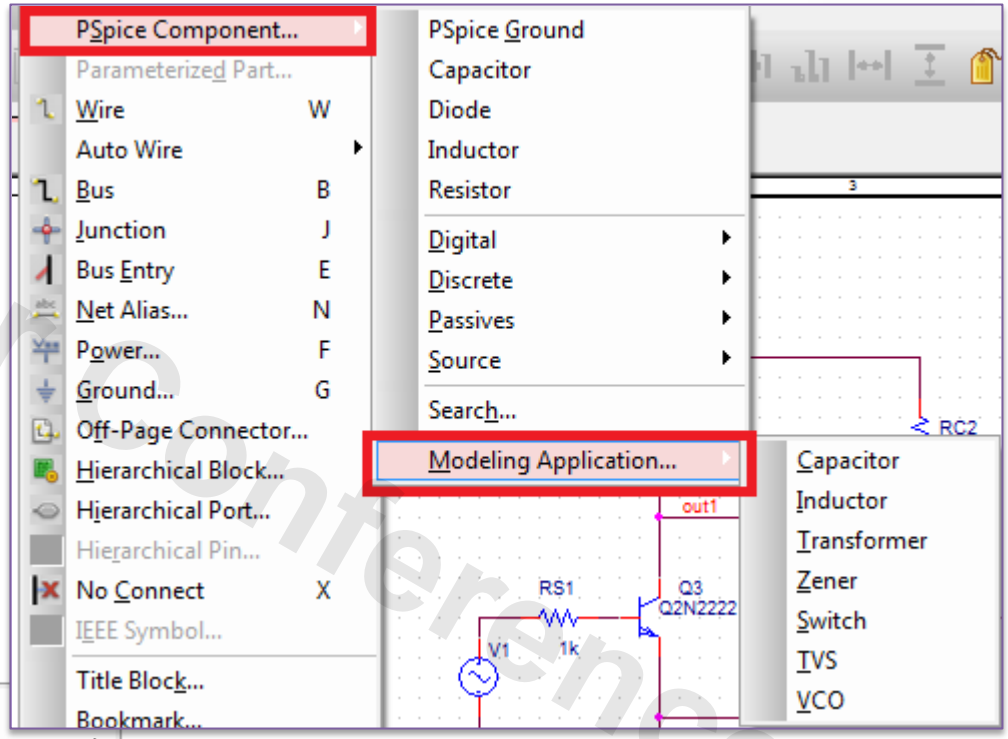


Model Support Enhancement

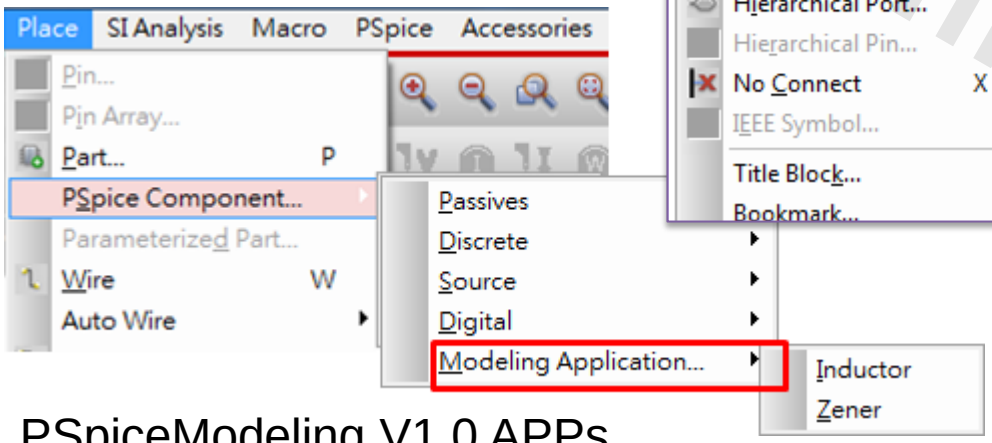
PSpice Modeling APPs

V16.6 QIR#

PSpiceModeling V2.0 APPs



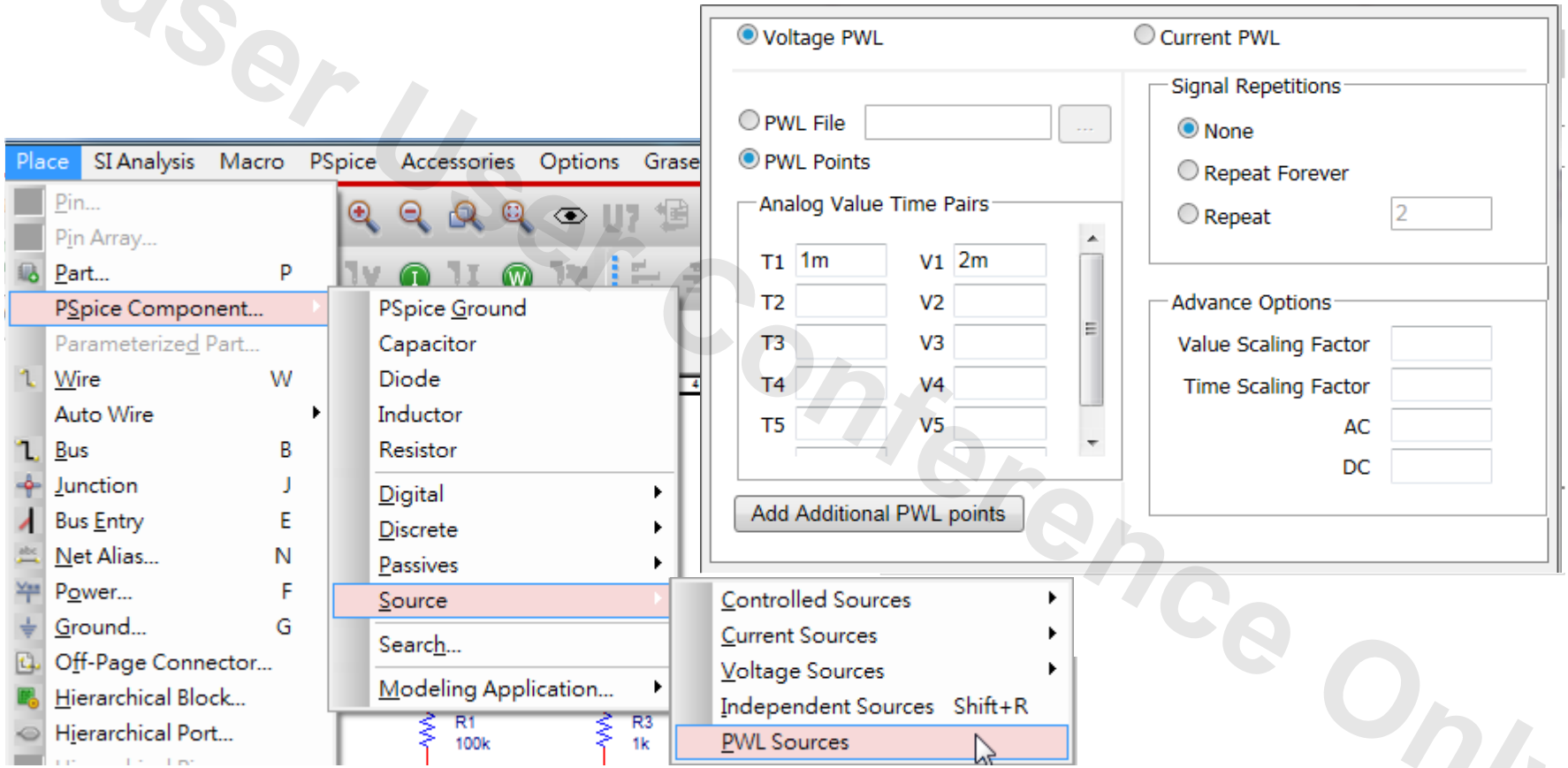
V16.6 Basic



PSpiceModeling V1.0 APPs

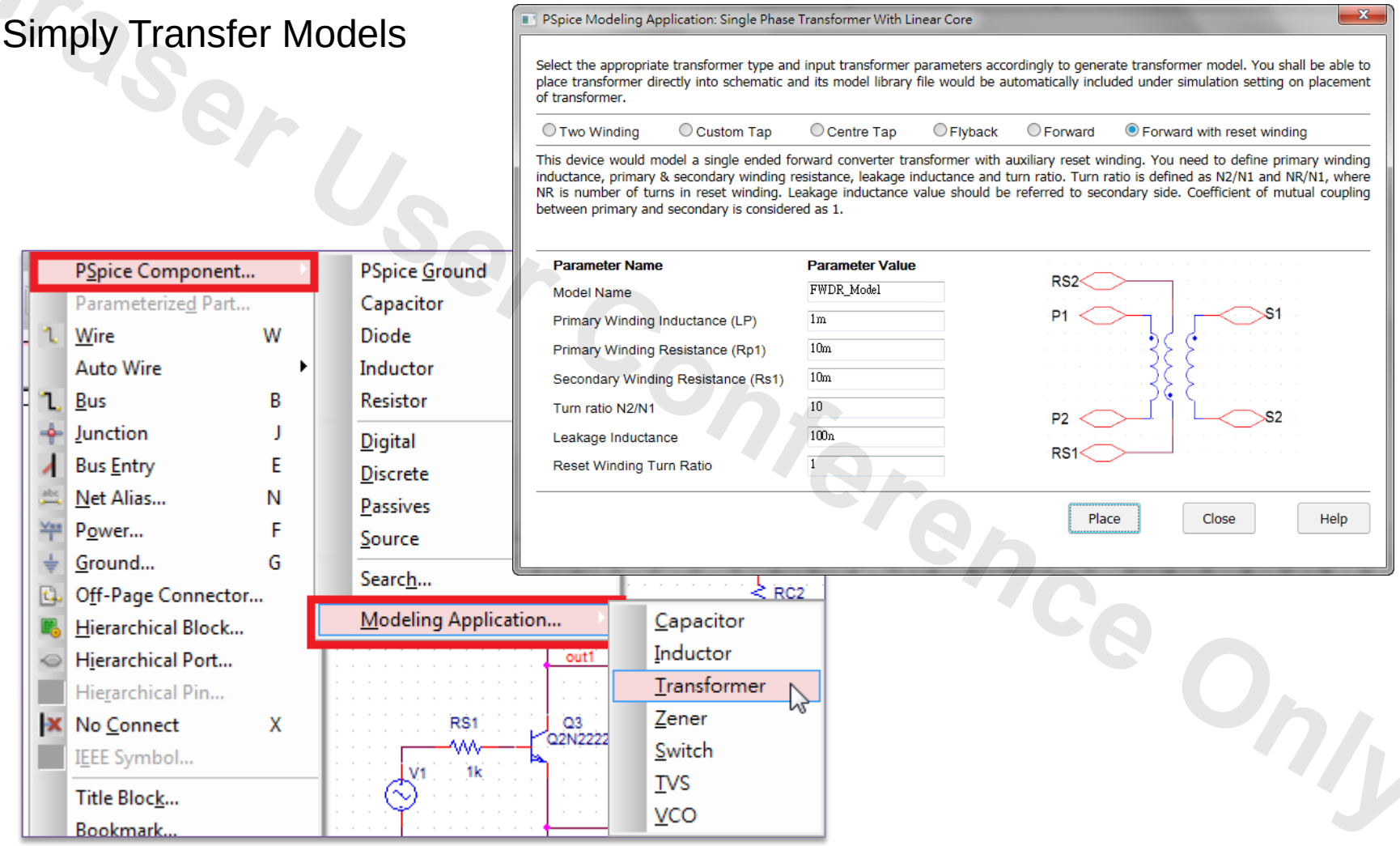
Model Support Enhancement

PSpiceModeling Apps V2.0



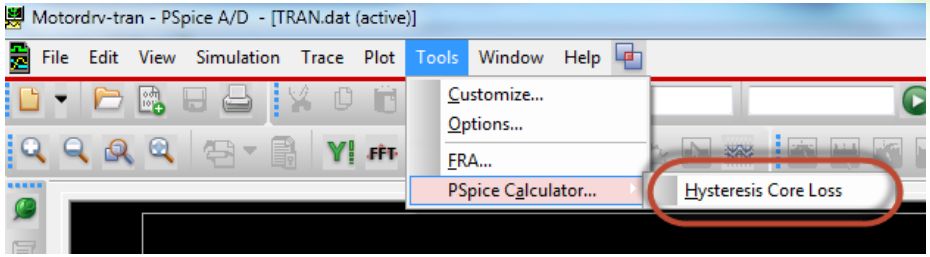
Model Support Enhancement

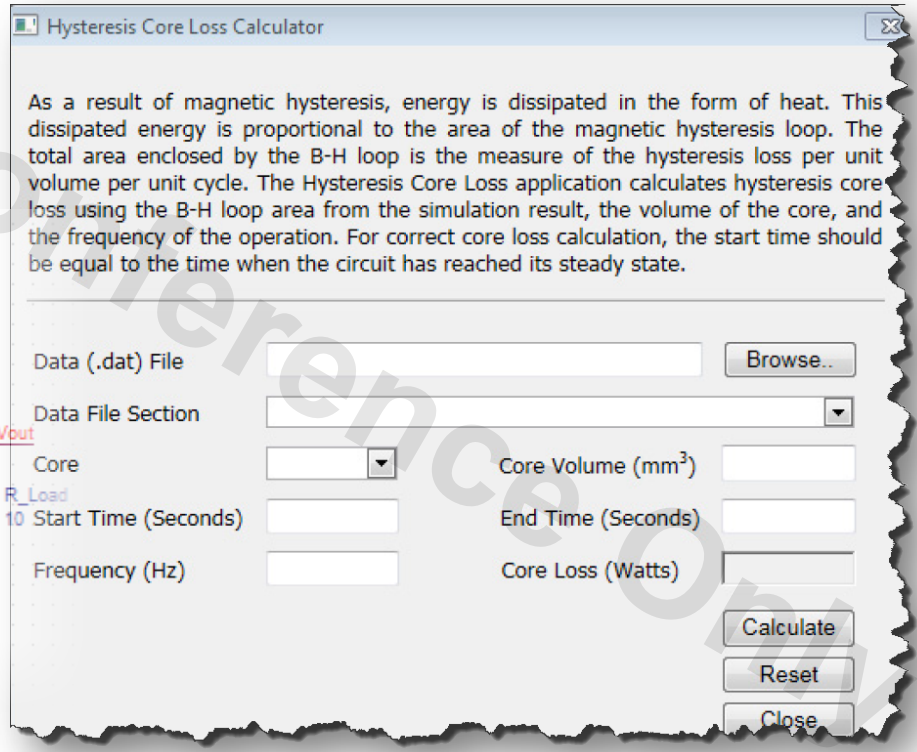
Simply Transfer Models

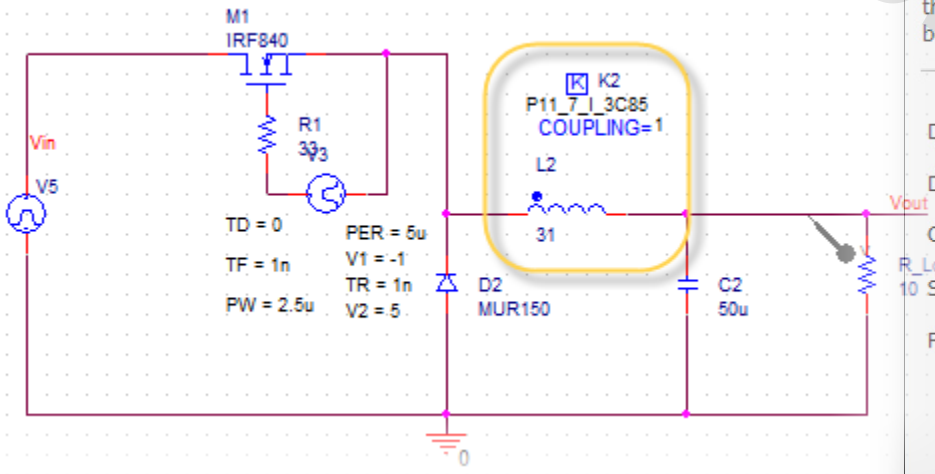


Hysteresis Core Loss Calculator

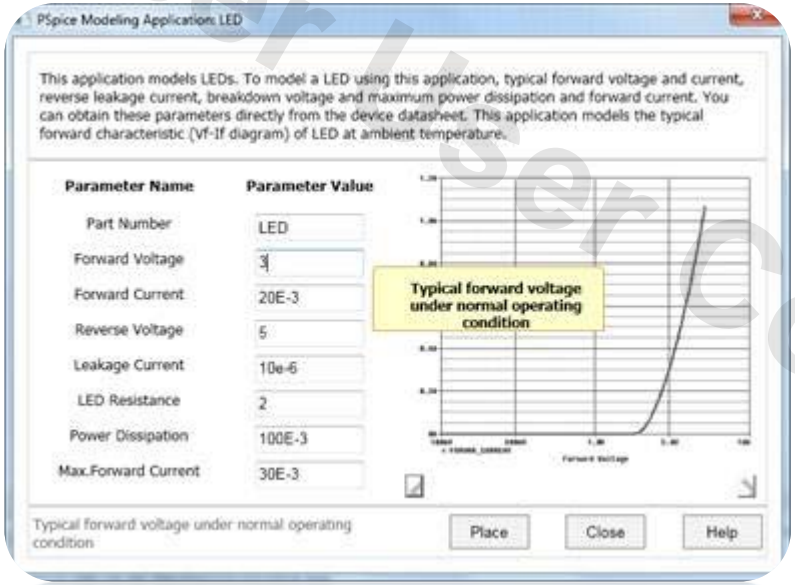
- App to measure Steady State loss of energy in a magnetic core for power supplies

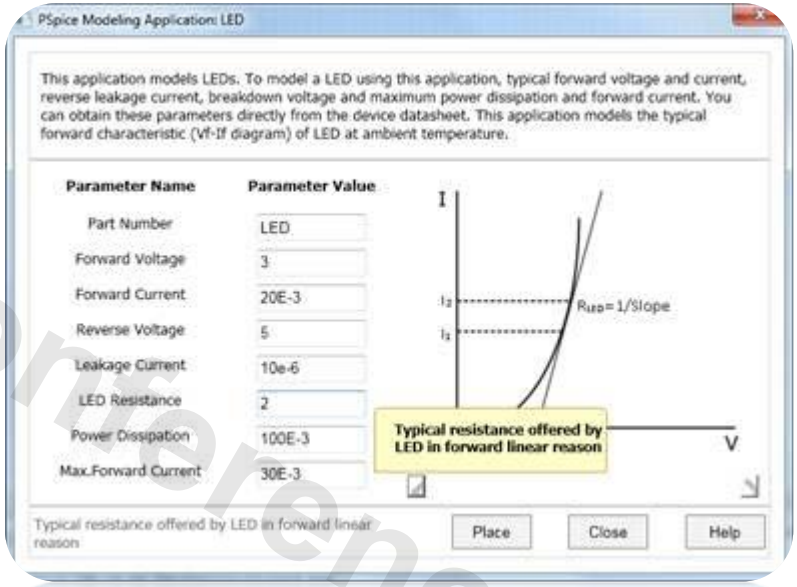






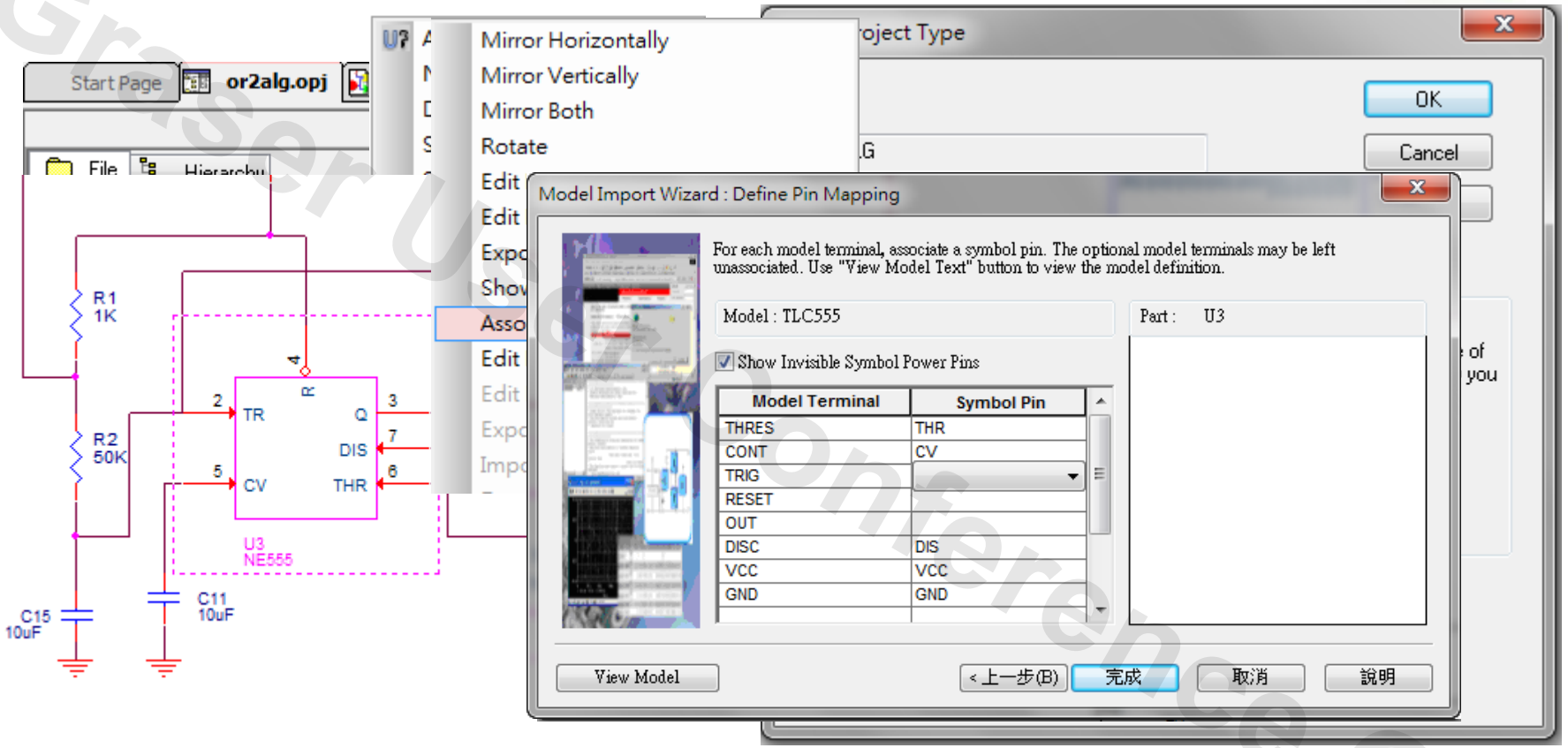
New PSpice Modeling App for LED Coming in QIR#8





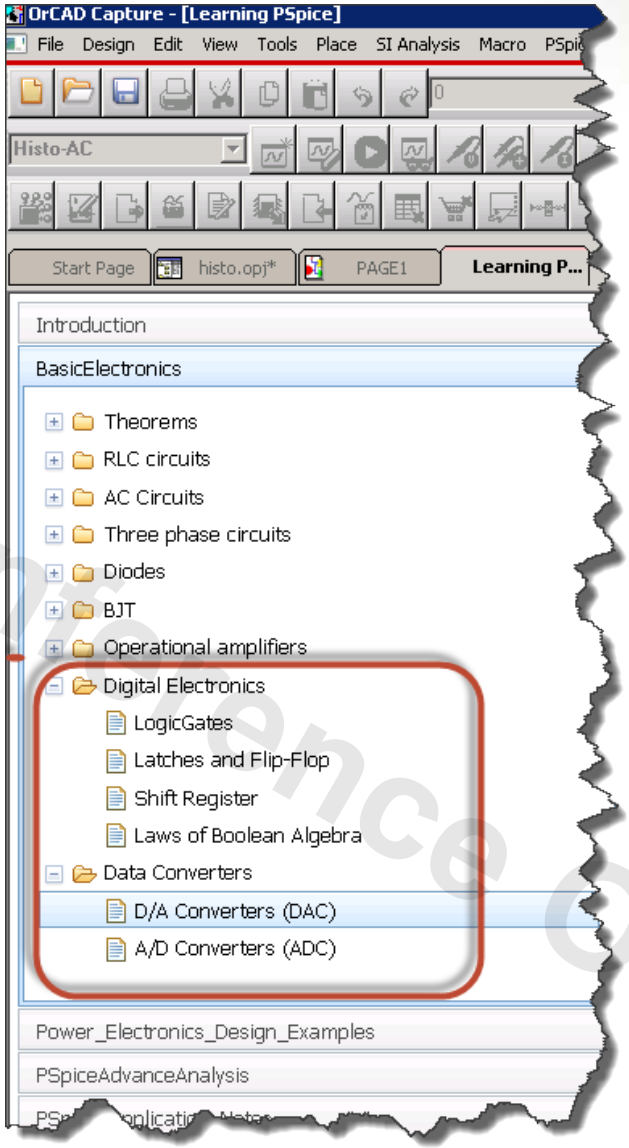
16.6 → Quarterly Incremental Releases → QIR#8

Model Assignment



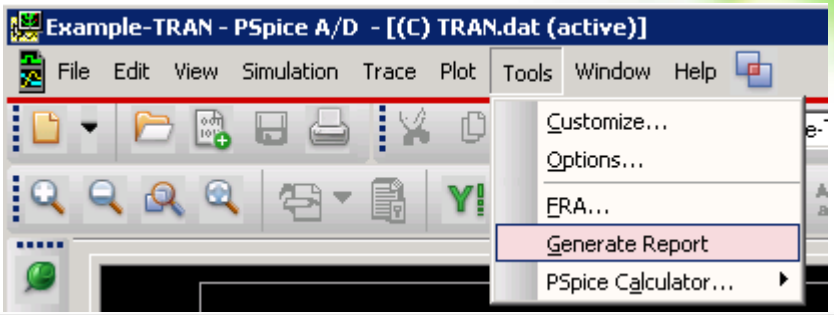
Learning with PSpice

- Instructional / introductory material on
  - Logic Gates
  - Latches
  - Flip-flops
  - Shift Registers
- PSpice Mixed-signal simulator chapters
  - Data converters
  - Analog-to-Digital (ADC)
  - Digital-to-Analog (DAC)



New Simulation Report Capability

- HTML report generated for Analog Transient simulation
  - Average, RMS, and Peak values of Current, Voltage and Power can be reported
- User customizable
  - Tcl source available in installation hierarchy
  - <installation>\tools\pspice\tclscripts\orPspReport
- .TCLPOSTRUN command can be used to configure auto-generation of HTML reports



Bias Value	Max Current	Min Current	Average	RMS	Max di/dt
-6.724173n	112.818u	-107.338u	2.0684u	79.711u	3.27156k
7.738638u	8.34771u	7.46526u	7.69682u	8.17574u	371.011

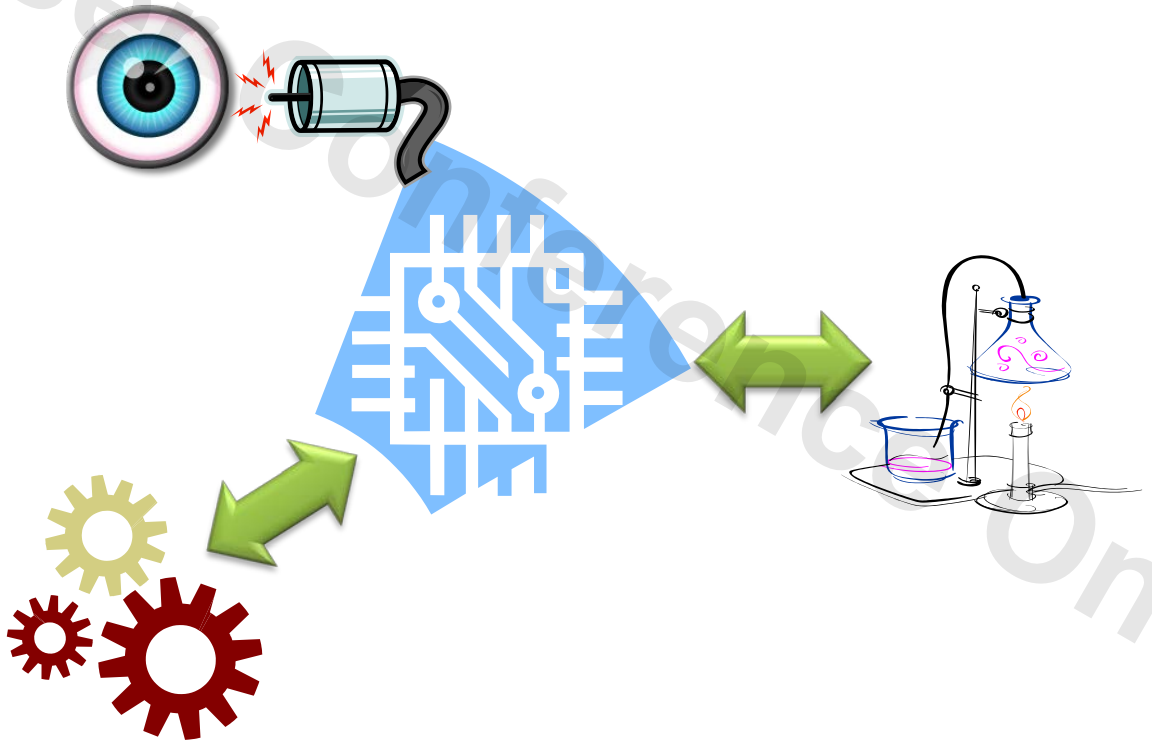
Bias value	Max Voltage	Min Voltage	Average	RMS	Max dV/dt
0.0	0.0	0.0	0.0	0.0	0.0
-4.294311m	52.1454m	-58.4785m	-3.52959m	40.1367m	1.66552Meg
-11.35038	-11.3503	-11.3505	-11.3504	11.3504	11.0859k
-4.302968m	37.276m	-47.5725m	-4.99191m	31.1941m	1.28267Meg
628.3144u	99.6763m	-99.6767m	30.7959u	75.9248m	3.14157Meg

Bias value	Max Power	Min Power	Average	RMS
1.809f	90.1598u	-85.9044u	1.05507u	41.5584u
753.4941u	756.526u	750.162u	753.428u	753.431u
14.9968m	15.1489m	14.8349m	14.9908m	14.9912m
3.990363m	4.59948m	3.31221m	3.95436m	3.98071m
3.989889m	4.77772m	3.2639m	4.00463m	4.03999m
27.26201m	27.2623m	27.2618m	27.262m	27.262m

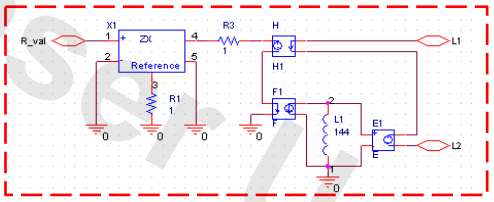
Miscellaneous

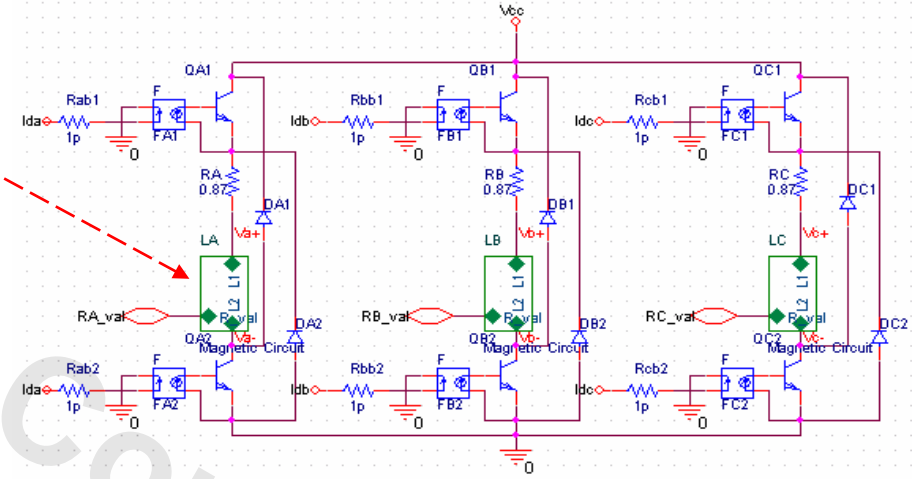
Mechatronics integration Design

- Example : Automotive Safety System
- Passive mode：ABS、Airbag、Reversing radar
- Active mode：DSTC , ROPS , EBD , CWFAB , PDFAB , DAC , LDW

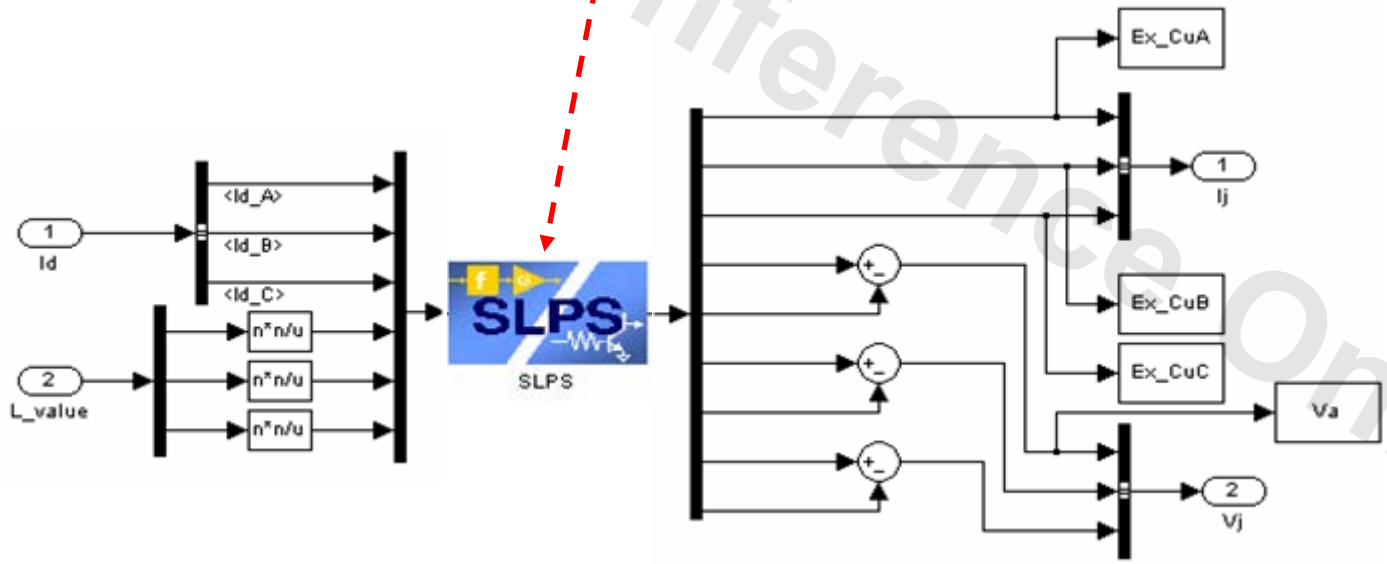


SLPS Option

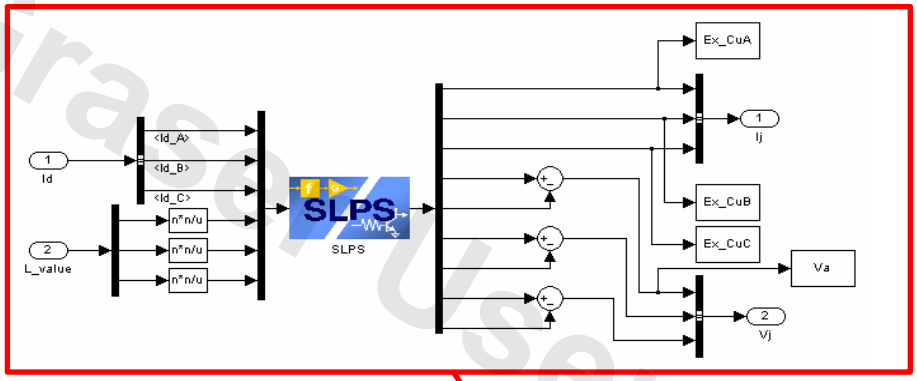


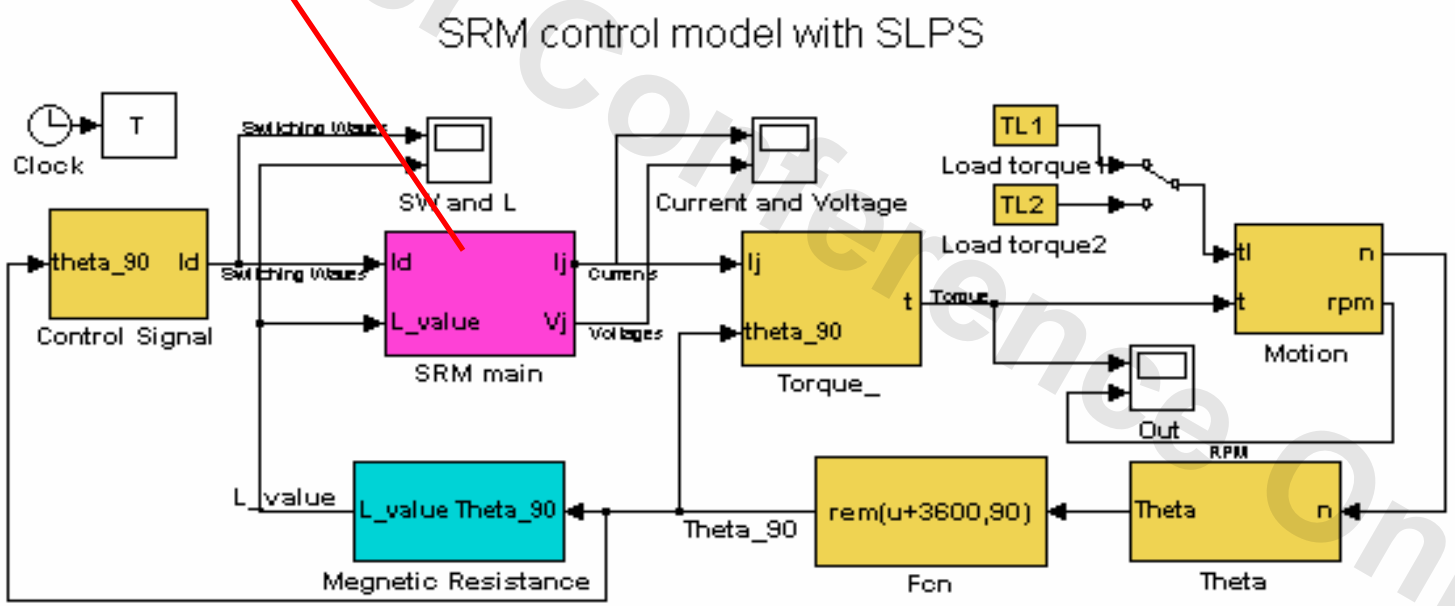


Modeling of electric circuit using PSpice

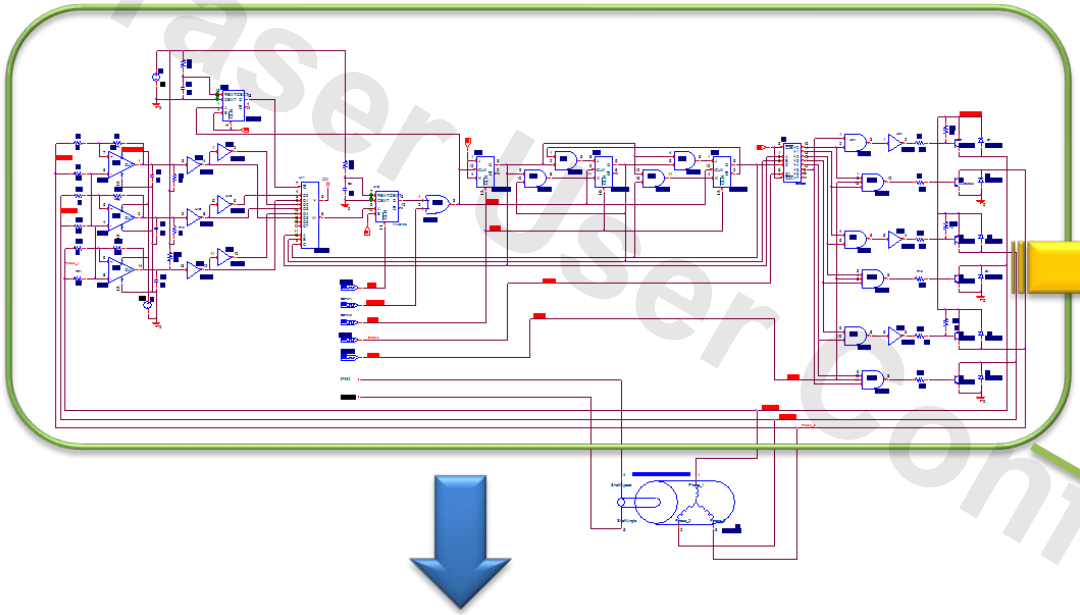


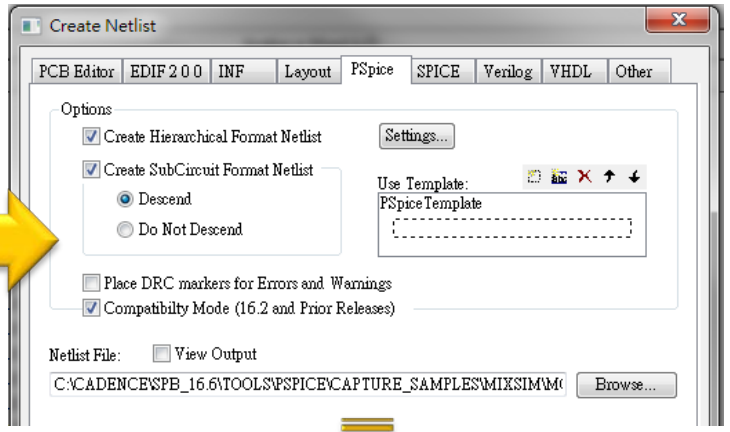
Multi-System Co-Simulation

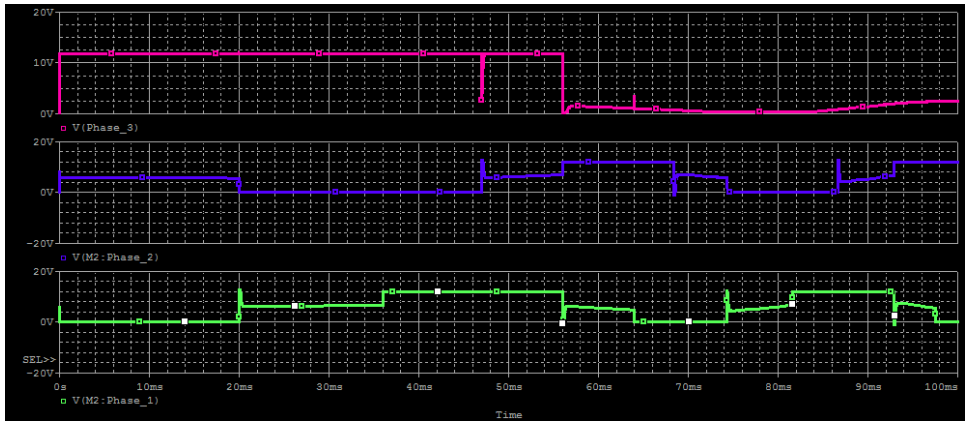


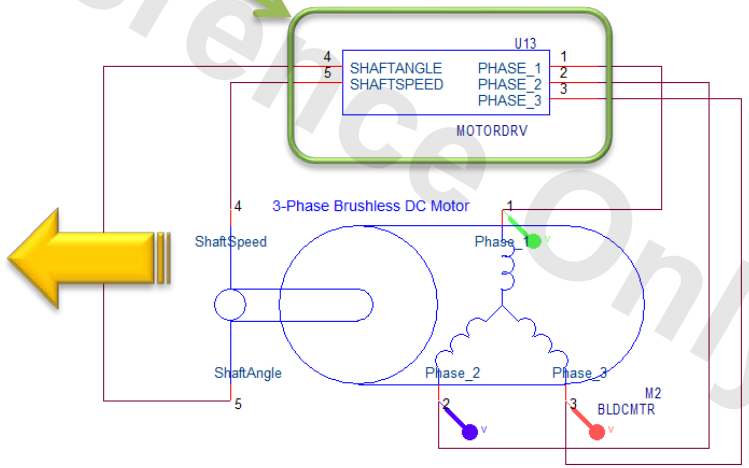


Modularized Design and Simulation









Modularized Design and Simulation