



# PEXPRT™

PExpert is a specialized software program that designs, analyzes and optimizes transformers and inductors found in power electronic applications.

Using a combination of classical and Finite Element Analysis (FEA) techniques, PEXprt determines the appropriate core size and shape, air gaps, and winding strategy of the component for optimum reliability and performance or other user-specified criterion.

## OVERVIEW

PExpert is ideal for designers of automotive and aerospace converters, switch mode power supplies and electronic ballasts. With PEXprt, designers can quickly calculate all possible combinations of core size, core material, wire gauge, turns, and gap length that satisfy user-supplied electrical specifications. The resulting “virtual” designs are then further refined and optimized using embedded finite element calculations to predict quantities such as magnetizing and leakage inductance, interwinding capacitance, peak flux density, DC winding resistance, eddy current effects, core loss and temperature rise. PEXprt also generates an equivalent-circuit model accounting for magnetic and thermal properties for use in SIMPLORER for complete circuit optimization.

## FEATURED CAPABILITIES

### DESIGN

- Voltage waveform input
  - sinusoidal
  - square
- Converter Input
  - Boost
  - buck
  - buck-boost
  - Forward
  - Half-bridge
  - Full-bridge
  - Push-pull
  - Flyback converters
- Considers all combinations of Core shapes, size, material, gap, wire type and gauge, and winding strategies to optimize the magnetic design
- Concentric, toroidal and planar components
- Planar components based on the PCB technology
- Evaluate
  - Interleaving
  - winding stacking
  - losses
  - temperature

### LIBRARIES

- Vendors: Ferroxcube®, Epcos®, AVX®, Magnetics®, Micrometals, Steward®, TDK, electrical steel, Metglas®
- Core Shapes: POT, RM, EE, EI, EFD, ETD, UU, EP, PQ, toroidal, T, I, DRUM, UI, laminated
- Conductors: Litz, solid, planar tracks, planar technologies, twisted, square, and foil

### RESULTS

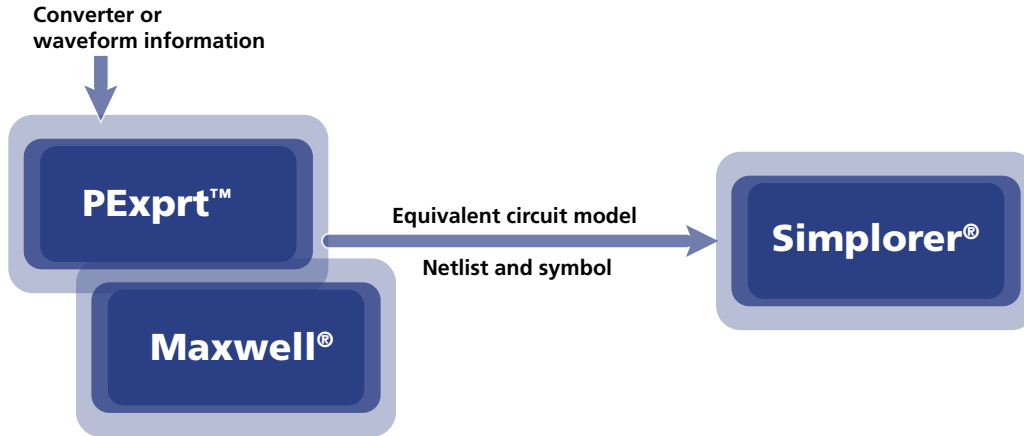
- DC and AC winding resistance and losses, considering Skin and proximity effects
- Core losses, considering hysteresis and eddy-current losses
- Major and minor hysteresis loop representation
- Analytical and FEA based results
- RMS and Current density in winding
- Construction (BOM)
- Flux density - maximum value and variation range
- Leakage inductance
- Temperature
- Complete model netlist for SIMPLORER®, PSPICE®

### MODELS

- Models account for
  - Winding position and stacking, including interleaving
  - Intra-winding capacitance
  - Temperature
  - Skin and proximity effects
  - Material characteristics, including non-linear and hysteresis behavior of the core
  - Frequency dependent resistance, leakage inductance and magnetizing inductance
  - Gap effect, end effect
  - Valid for arbitrary winding strategies
  - Intra-winding interleaving, Twisted wires
  - Bi-filar or tri-filar wires
  - Parallel connections

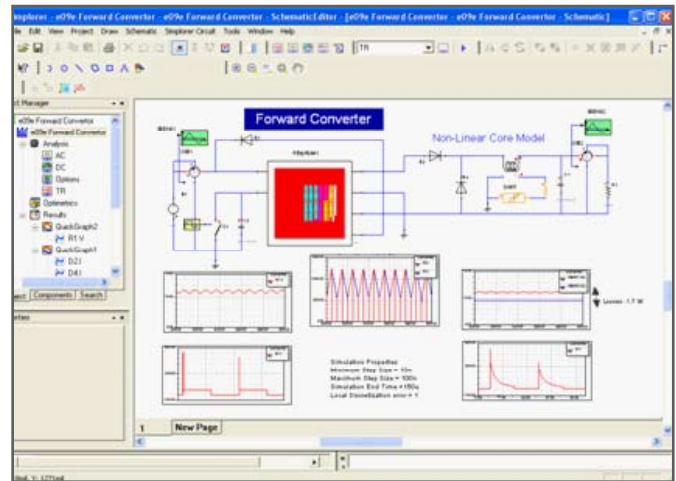
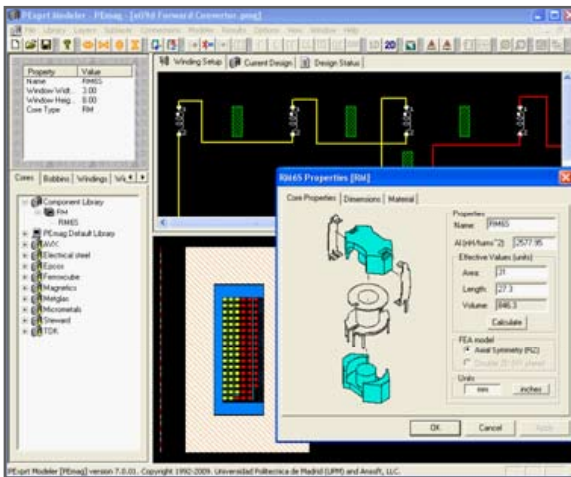
## DESIGN FLOW

PExprt is used to design, model, analyze, and optimize magnetic components, using analytical calculations and finite element methods that couple with Maxwell. The resulting behavioral level models can then be used to analyze and optimize the overall power converter and its relationship to the overall system. PExprt supports seamless import of these models into Simplorer, which is a powerful multi-domain system analysis software program. Using Simplorer, the magnetic model based on the exact design construction can be evaluated within the power converter circuit to evaluate exact power loss, switching waveforms, component stresses, control loop stability, etc.



## APPLICATIONS

PExprt generates accurate models of the magnetic component based on finite element analysis using the actual construction and materials information. This model can be imported in Simplorer to aid design, analysis, and optimization of the power converter.



Detailed modeling and simulation of a forward converter transformer



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