

■ **BRUSHLESS PERMANENT MAGNET MACHINES**

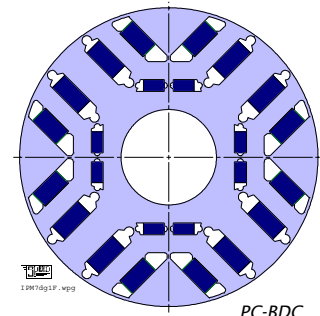
— **Designing a Brushless IPM AC motor with sinewave drive**, using *PC-BDC*. Torque. The phasor diagram and voltage locus diagram. Resistance, EMF, and inductance. Saturation effects. The *i-psi GoFER* and the embedded FE solver. Multi-layer IPM. The open-circuit magnetic field. Precise EMF calculation. Cogging torque calculation. *Demagnetization*

■ **Steel data preparation.**

■ **Designing a Fractional-slot BLDC Motor with Sine or Squarewave Drive**, using *PC-BDC*. Choice of slots and poles; winding design. MMF harmonic effects. Advanced loss calculations including harmonic losses, slot-modulation losses, special magnet losses.

■ **Cogging torque**, and how to minimize it.

■ **Drives and controls. The Dynamic design function in PC-BDC.** The voltage locus diagram. Torque/speed characteristics; Flux-weakening; constant-power speed range. Current regulators. Control of switching frequency and current ripple. k_T and k_E , and their relation to inverter selection. The **machine characteristics** utility in *PC-BDC*.



PC-BDC



■ **Designing a wound-field AC generator using PC-BDC.**

— Salient-pole and cylindrical- rotor types

■ **Precise EMF calculation. Inductance analysis. Short-circuit ratio; synchronous reactance.**

■ **Generator characteristics : open-circuit, short-circuit, and others**

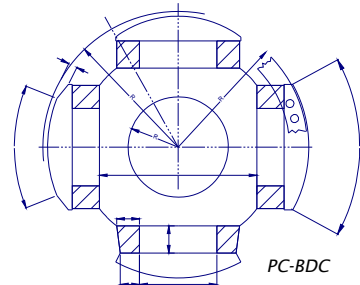
■ **Specification of loads: V- δ , I- γ , P-V, I-PF, etc. The voltage-driven embedded finite-element solver.**

■ **Sudden short circuit fault. Multi-phase machines; high- speed machines; superconducting machines.**

■ **Thermal calculations in PC-BDC.**

— Detailed example of the Hot10 model

■ **Designing an Axial-flux machine using PC-AXM.** Theory of axial-flux machines. Choice of slots and poles; winding design. EMF calculation. Inductance. Performance calculations.

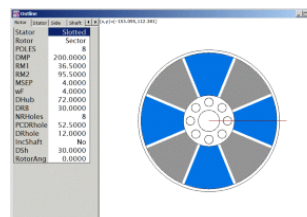


PC-BDC

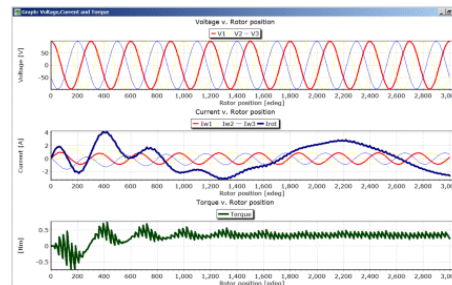
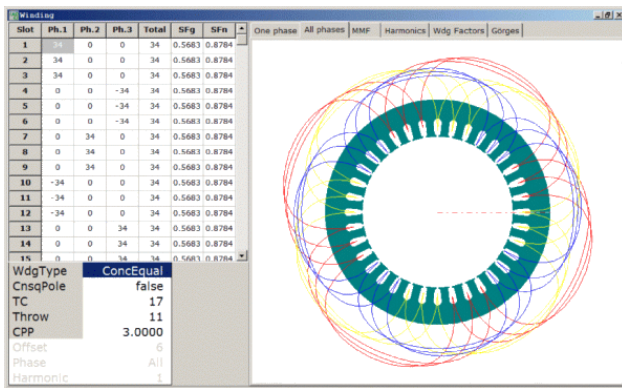
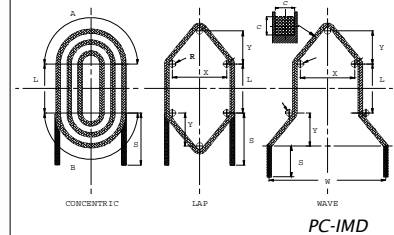


Many of these generator calculations apply to permanent-magnet machines also

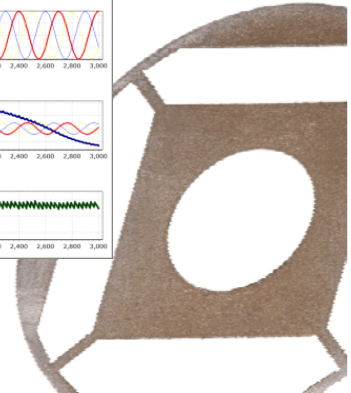
PC-AXM



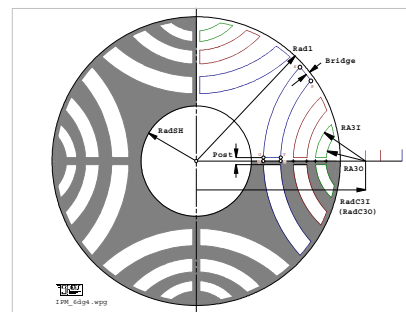
- **Designing a 3-phase Induction Machine using PC-IMD.**
- Theory & operation. The equivalent circuit, with detailed explanation of all its parameters. Effects of saturation on magnetizing and leakage reactances.
- Using the finite-element GoFER with PC-IMD.
- Doubly-fed (slip-ring) machines, with different rotor circuits and slip-energy control methods.
- The direct simulation of the induction machine using connection matrix methods with finite-element-calculated primitives.
- **Designing a Single-phase Induction Motor using PC-IMD.** Principles of single-phase motors; auxiliary circuits; methods of calculation.



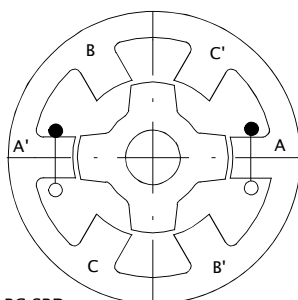
PC-IMD



- **Reluctance machines and weak-magnet machines**
 - Increasingly important, because of concerns about magnet availability
- **Designing a synchronous reluctance/IPM hybrid machine using PC-BDC**
 - Several reluctance machines and weakly-magnetized hybrids can be modelled in PC-BDC, with all the functionality of the GoFER, the embedded solver, and the drives and controls simulation
- **Designing a Switched Reluctance Machine using PC-SRD,** including drive, control, and finite-element GoFER.



PC-BDC



PC-SRD

