Engineers and scientists who design and model prototypes need fast and reliable field solutions. Today, simulation software allows professionals to design via computer simulations thereby reducing costs and risks associated with physical prototyping.

INTEGRATED Engineering Software is a pioneer in providing hybrid simulation tools for electromagnetic, thermal and structural design analysis.

As a scientist, you want to decide which field solver best suits your application. INTEGRATED's field solvers have been proven in a diverse range of applications for over 25 years. Our **Boundary Element Method (BEM)**, **Finite Element Method (FEM)** and **HYBRID** solvers are available in the same package to allow you to select the best method for any problem. Now, you can independently verify the solution within one program, and avoid the time and effort of verifying through a second program.

Fast. Accurate. Easy-to-use.

- Design optimization by **powerful parametric solvers:** allow designers to automatically vary and experiment with geometry, materials and sources – reducing the tedious, repetitive task of fine-tuning multiple design parameters
- **Very short learning curve;** no scripting required
- **Full parallel processing:** faster solutions than ever before
- **Link to CAD packages** for true representation of complex geometric shapes

INTEGRATED has developed powerful simulation tools that now allow the analysis of combined field effects, seamlessly.

Design of electromechanical equipment, such as motors and solenoids, requires electromagnetic simulation software specifically designed for **magnetic analysis** which inherently includes coils and windings and the ability to do transient analysis. For the design of sensors, magnetic shielding, or specific applications like MRI, very high accuracy of the field may be required.

INTEGRATED's CAE software offers the **Finite Element Method (FEM)** and **Boundary Element Method (BEM)** to specifically cater to this wide variety of applications in the magnetic analysis field.

The geometry of the magnetic problem can be created with the geometric modeler built into the magnetic field solvers or can be imported from any of the major CAD vendors. More importantly, the geometry can be changed parametrically to optimize a design for robustness, weight, size and, of course, cost.

For some electromagnetic or electromechanical applications, Eddy currents are generated intentionally, such as with induction heating. In most cases, however, unwanted heat loss occurs due to Eddy currents. In any event, the heat generated by the Eddy currents can be used by the INTEGRATED's thermal analysis modules to determine the temperature throughout the device.

Multiphysics combined with different solver technologies provide the optimal solution for any electromagnetic or electrothermal problem.

Check our versatile tools, with 2D and 3D analysis options.

Other advantages of INTEGRATED's simulation tools include:

- Integration of an effective calculating method, accuracy and engineer-oriented approach
- Line currents for modeling thousands of current sources
- Easily draw a conceptual model for a new piece, then analyze field stresses & capacitance on an iterative basis. The design can be easily modified (i.e. stretching, transforming and rotating parts of the geometry)
- Capable of solving problems with nonlinear permeability and magnets with nonlinear demagnetization curves
- Option to solve magnetic rotationally symmetric problems for a more realistic solution
- Simple generation of model using BEM or FEM
- Automatic meshing and removal of intersecting geometries
- Easy direct import/export of geometries from/to CAD tools providing a first result within several minutes
- Export for presentations; excellent graphic representation
- Unique streamlined analysis
- Healing tools for repairing CAD errors such as overlaps, intersections and small gaps in model geometry

Our technical team, staffed by scientists and engineers, will assist you in the selection of the tool that best suits your application needs.

PUT OUR SOFTWARE TO THE TEST

CALL FOR A 30-DAY **FREE EVALUATION** AND START IMPROVING PRODUCTIVITY TODAY.

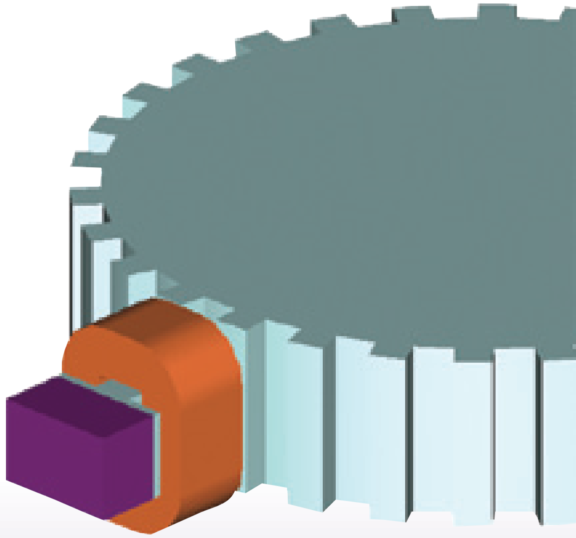
A **live demo** is also available.

INTEGRATED
ENGINEERING SOFTWARE
Call **1.204.632.5636**
E-mail **info@integratedsoft.com** or visit **www.integratedsoft.com**

INTEGRATED

INTEGRATED 25 YEARS optimizing designs

MAGNET ANALYSIS SOFTWARE



Hybrid simulation tools for electromagnetic, thermal and structural design analysis

How can INTEGRATED's simulation tools help you?

- Improve product quality while cutting engineering time and costs
- Reduce the product-to-market cycle
- Design a wide variety of electromagnetic and electrothermal field models
- Test how a magnetizing fixture will actually work
- Optimize sensor shapes and locations
- Maximize the magnetic field while minimizing materials
- Test various magnets for performance versus cost

Analyze and model:

- Forces & torques in motors, magnetic bearings, magnetic couplings, as well as current carrying coils for loudspeakers and voice coil actuators, among others
- Field values vs. position for Hall Effect sensors
- Flux linkage and induced voltage for Variable Reluctance sensors
- Particle trajectory analysis with steering and focusing magnets
- Optimized shapes of coils and pole pieces for electromagnets such as those used in MRI machines and magnetizing fixtures
- Transient analysis for "fast acting" devices

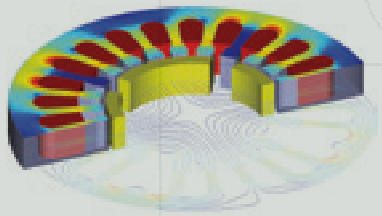
SOME APPLICATIONS

Motors

One of the most common uses of permanent magnets is for creating the magnetic fields in electric motors. The only way to try new concepts or to optimize an existing design is by either finite element or boundary element simulation.

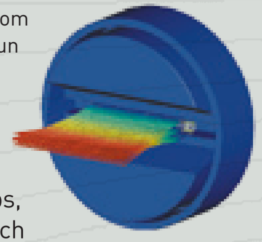
Some of the common parameters available are:

- Torque curves as a function of angular position
- Flux linkage calculations for determining the back electromotive force
- Losses which can then be used to calculate the thermal profile of the motor
- Advanced winding features which enable the designer to include winding diagrams in the finite/boundary element analysis
- Transient calculation such as current and torque versus time



- Magnetic field strength in motor core

Particles



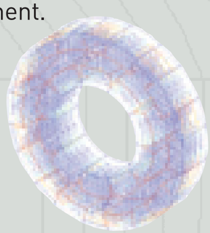
- Beam from electron gun

Various kinds of magnet assemblies are commonly used to affect the path which charged particles follow. This can be for particle accelerators, beamlines, ion traps, or miscellaneous similar applications such as plasma confinement. The magnets are typically used for some combination of steering and focusing beams of charged particles. By including the LORENTZ analysis module, any of INTEGRATED's magnetic analysis programs can be used to simulate such applications.

Magnetic clutches

For many practical applications, it is necessary to provide a breaking clutch. 3D INTEGRATED's software is ideally suited for this type of application. Since its boundary element method does not require meshing any air space, it is a simple matter to set up parametrics which modify the design and provide the correct breaking torque.

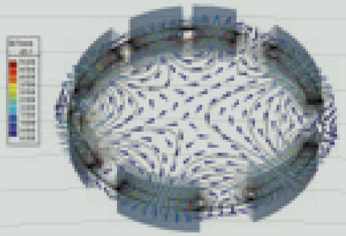
Unlike a finite element solution, the mesh does not have to be recreated at each new position of magnet alignment. The software comes with a built in library of materials which is easily extended by the user's own commonly used library of materials.



- Field lines in and around magnetic clutch

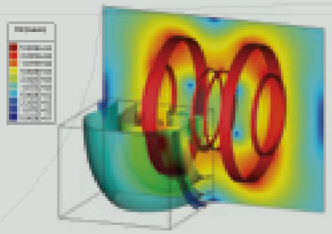
Sensors

Sensors are required almost everywhere. This may include measuring the fuel in your tank, monitoring the position of a shaft or measuring the speed of a device. Many of these measurements are made by producing a magnetic field using a magnet and then measuring flux produced by the magnet at one or more locations.



- Magnetic arrangement for magnetic encoding device

As most of these problems involve large amounts of free space, the boundary element method is ideally suited for these applications. Voltage calculations are simply derived by the software calculating the rate of change of flux within a coil. Thus, determining the size of magnets and coil or the desired amount of turns per coil to optimize the design can be automated easily. Contour plots, graphs, isosurface and arrow plots enable the designer to see the "flow" of the magnetic field to optimize sensor locations.



- Magnetic field density around MRI coils

Magnetic encoding

Magnets are commonly used for encoding information in a wide range of devices. This may include buried magnets in shafts to detect the speed and position of a gear. Other magnetic devices are used to store numbers or text by encoding a magnetic material with a magnetization pattern.

INTEGRATED's software, in 2D/3D, is ideally suited for this task. Commands are available to first place the magnets in a magnetizing fixture. The magnets can then be taken out of the fixture and placed in the design to calculate the magnetic field pattern. This powerful feature enables the complete design of a magnetic encoding system.

MRI

Magnet Resonant Imaging (MRI) machines require large magnets to produce a very large linear field over a specified volume. Unlike most magnet simulations, the field accuracy has to be extremely high. For practical problems, this may mean field calculations with error in parts per million.

This accuracy is met by using a boundary element model. Unlike finite element calculations, a potential is not differentiated to get the magnet field because this leads to large numerical inaccuracies. Instead, the real and equivalent sources are integrated to yield extremely high accuracy. In addition, the software can be used for stringent room shielding requirements.