

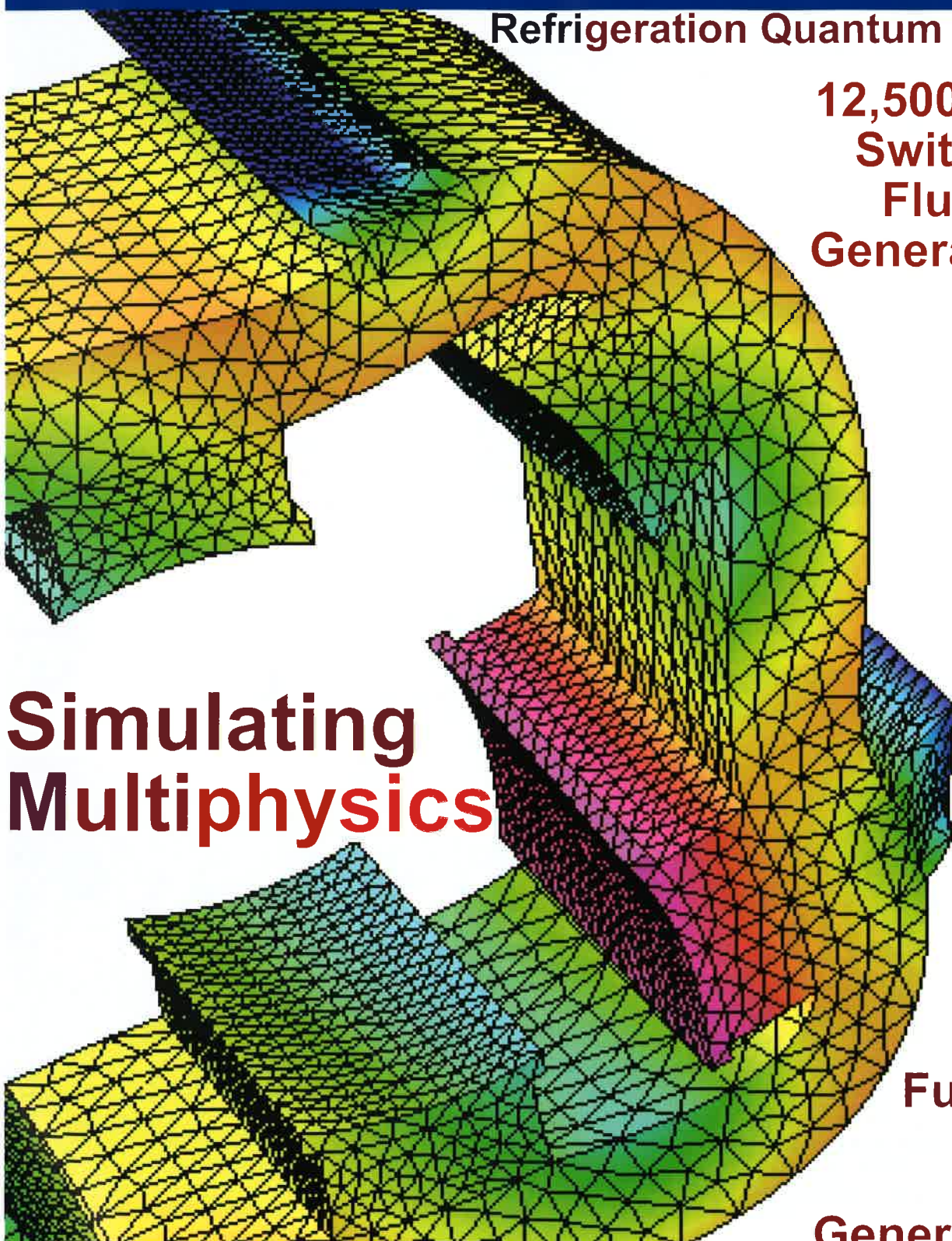
# MagNews

The international publication  
of the UK Magnetics Society

Spring 2013

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**Simulating  
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## Bartington's fluxgate adapted for Metrolab's THM1176 family

Like Bartington Instruments, Metrolab Technology SA builds magnetometers. The key difference is that Metrolab's magnetometers are designed for very strong fields. One of its product lines is a range of three-axis Hall effect magnetometers able to resolve up to  $2\mu\text{T}$ , but even this is insufficient for some purposes. Metrolab has now been able to extend the resolution into the nT range, thanks to Bartington's Mag649 low-power three-axis fluxgate sensor.

### Applications down to nT

Metrolab's THM1176 family of sensors is a range incorporating integrated drivers and amplifiers with highly integrated low-power electronic components and software control and display (see Figure 1). The result is a compact, portable instrument that Metrolab describes as essentially just 'a cable with some fat spots'. While the range of products is ideally suited to measuring strong magnetic fields, its resolution is limited. The highest resolution product, the THM1176-LF ('Low Field'), has a range of 8mT and a resolution of  $2\mu\text{T}$ . Even this is insufficient for (to take an example) measuring the small magnetic field

fluctuations, perhaps due to elevators or ground currents, that could distort the images of an MRI scanner. In this example, even  $\mu\text{T}$ -level fluctuations, representing approximately 1 ppm (part per million) of an MRI system's main field, are relevant. It is important to assess these effects before installing the scanner, as this will influence the extent and type of magnetic shielding required, and to make periodic checks thereafter. A handheld, battery-operated system that could read at this resolution would allow the installer to perform such measurements easily, even on a construction site.

### Integrating the Mag649

Measuring fluctuations at the  $\mu\text{T}$ -level calls for fluxgate rather than Hall technology. After evaluating several fluxgate magnetometers, Metrolab quickly settled on Bartington's Mag649. It was an ideal match for the THM1176 family, the key parameters being three axes, low power, compact form, robustness,  $\pm 100\mu\text{T}$  measurement range, and 1 kHz bandwidth. Metrolab also comments that it has "noise figures that render all self-respecting Hall sensors green with envy."

A prototype proved the concept's promise and was quickly developed into the final product, the TFM1186 Three-axis Fluxgate Magnetometer (see Figure 2).

For more information, please visit: [www.bartington.com](http://www.bartington.com)

### Magnetometer Principles Hall Effect

A continuous current is passed through a thin slab of semiconductor material. When the material is placed in a magnetic field, the electrons of the current are deflected to one side of the slab. This produces a potential difference between the two sides of the slab, creating a detectable voltage that is proportional to the magnetic field. Therefore measuring this voltage provides information about the magnetic field that produced it. Hall effect magnetometers are often used to regulate or provide information about moving machinery or strong magnetic fields.

### Fluxgate

Two coils are wrapped around a magnetically susceptible core. An alternating current is passed through the first coil, which induces an alternating magnetic field in the core. This induces a current in the second coil. In a magnetically neutral environment, the currents in the two coils will be the same. If the core is exposed to a background field, it will be magnetised more easily when it is aligned with that field and less easily when it is not. Hence the magnetic field and the induced output current will be out of step with the input current. Thus, measuring the output current provides information about the external influences on the magnetic field produced by the core.



Figure 1 Family portrait of Metrolab's 3-axis magnetometers. The line encompasses probes for fields up to 14T or, using a Bartington Mag649, down to nano-teslas.



Figure 2 Metrolab's Three-axis Fluxgate Magnetometer, TFM1186. For simplicity, the differential receivers are on a second PCB, requiring a slightly larger housing than for the THM1176.

## Design of Electrical Machines with ANSYS Maxwell & Simplorer

Free Webinar, 17/07/13, 2.00pm GMT (9.00AM EST), Duration: 60 Minutes

ANSYS Maxwell is an electromagnetic field simulation software for engineers, tasked with designing and analyzing 3-D and 2-D electromagnetic and electromechanical devices, including motors, actuators, transformers, sensors and coils. Maxwell uses the accurate finite element method to solve static, frequency-domain, and time-varying electromagnetic and electric fields.

A key feature in ANSYS Maxwell is the ability to generate high-fidelity, reduced-order models from the finite element so-

lution for use in ANSYS Simplorer a multi-domain system simulation software. The ability to dynamically link Maxwell to Simplorer using reduced-order models or, alternatively, to perform co simulation between the Maxwell transient solver and Simplorer provides a powerful electromagnetic-based simulation environment.

This WebEx will present the different modelling methods available to electromechanical design engineers, using induction and synchronous motors as examples.

Multilevel modelling methods are

compared, starting from mathematical expression based models through to behavioural and finally fully transient coupled models. The speed versus precision trade-off is discussed at each stage.

During the WebEx, models are presented using the following ANSYS products:

- Simplorer: Circuit and System Simulator
- Maxwell: Finite Element Method Electromagnetic Field Solver
- RMxprt: Rotating electrical machinery design tool