

Evolutionary MRI Magnet Design

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MRI Systems: New Challenges

Magnetic Resonance Imaging (MRI) is an imaging technique widely used to produce high quality images of the inside of the human body.

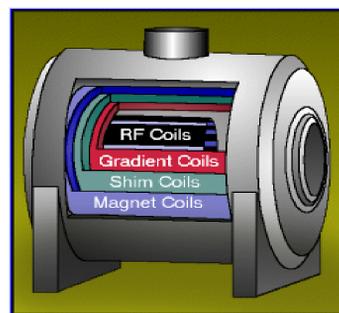
A typical MRI system is like a cylinder. It contains a deep bore in the centre where the patient is to be placed. The magnet is used to produce an intense and homogeneous field in the region to be imaged to get images of good quality.

A major challenge in MRI magnet design is to produce shorter magnets so that the perception of claustrophobia experienced by patients can be reduced. This is a significant engineering challenge as the field homogeneity is strongly dependent on the overall length of the coil structure.

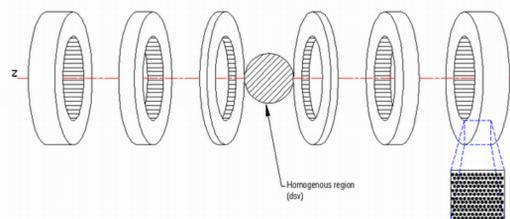
Another challenge comes from the design of special-purpose, open MRI systems. Traditionally, the imaging area of MRI systems is within the centre of the bore, surrounded by symmetric coils. In an open MRI system, the area is moved to the open end of the bore so that only part of body needs to be placed into the system. A potential application is a MRI system dedicated to breast cancer detection.



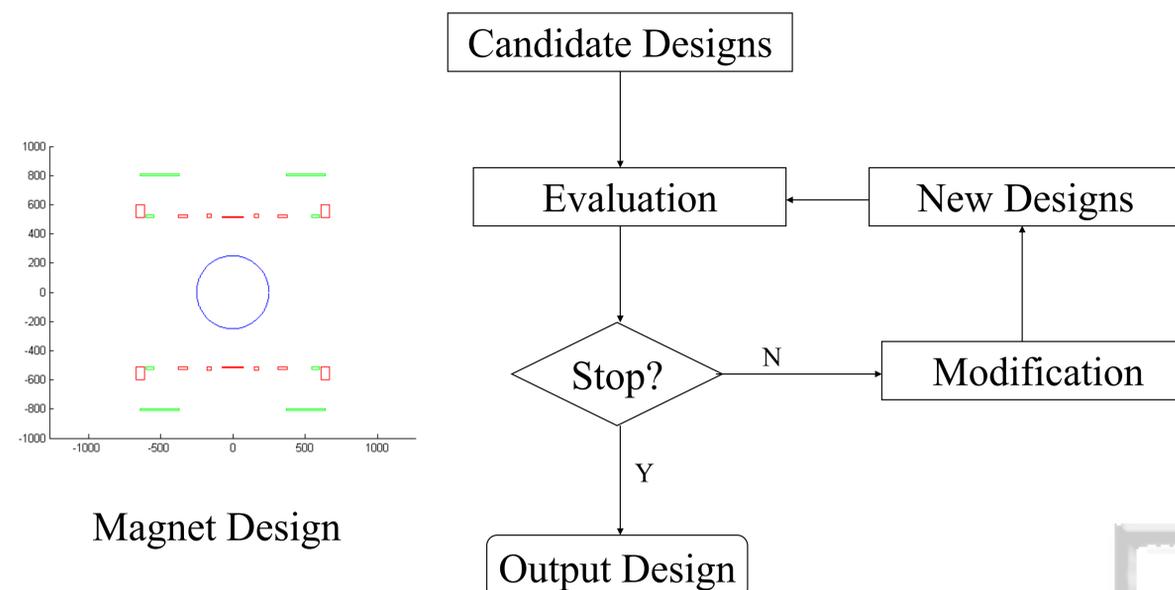
A MRI System



Structure of MRI



Magnet Coils



Magnet Design

Diagram of EAs

Evolutionary Design

In the past, analytical design methods have typically been used for magnet design. However, it is very difficult to apply these methods to the design of novel MRI systems.

Evolutionary Algorithms (EAs) are well-known to be good at global optimization and have been successful in solving many complex real-world problems. Our objective is to apply EAs to superconducting MRI magnet design with a focus on short and open systems.

Contact

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