

Optimizing permanent magnets system for a magnetic targeted drug delivery

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One of the main challenges in medical applications today is a drug delivery to the desirable area. The possible solution is the usage of ferrofluid particles as drug carriers guided by a nonuniform magnetic field. Design of the corresponding permanent magnet system which should produce the field gradient with the maximal magnitude and the prescribed orientation *in an extended area* is still an open question.

This talk is devoted to the numerical optimization of the magnetic field gradient and hence - a magnetic drag force - *in the whole area of the vitreous body of an eye* by placing permanent magnets around the human head. The purpose of this system is the drug delivery to the eye retina. The main problem here is a fast decrease of the magnetic field amplitude and the corresponding field gradient in the eye region if permanent magnets are positioned only behind the eye.

We present the optimization procedure with a special focus on the magnetization direction of permanent magnets (Fig. 1) composing the magnetic system. Different geometrical patterns with various numbers of permanent magnet layers are considered. The flexibility of our approach allows to maximize magnetic field gradient in the desired area, taking into account the prescribed gradient direction (based on medical experts recommendations).

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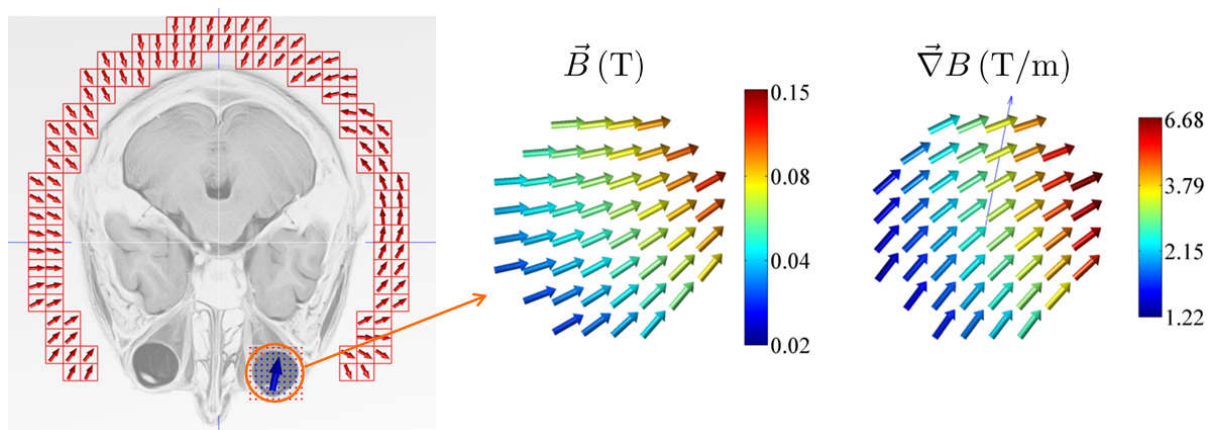


Figure 1. Left to right: An example of permanent magnets placement and the corresponding magnetic field and magnetic field gradient in the area of the vitreous body.