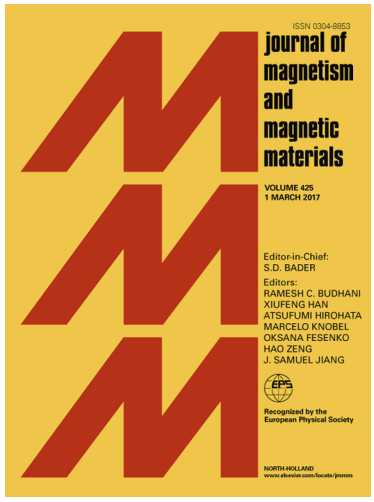

Research articles

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Numerical Simulation of Magnetic Nano Drug Targeting in a Patient-Specific Coeliac Trunk. ☆

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Abstract

Magnetic nano drug targeting, through the use of an external magnetic field, is a new technique for the treatment of several diseases, which can potentially avoid the dispersion of drugs in undesired locations of the body. Nevertheless, due to the limitations on the intensity of the magnetic field applied, the hydrodynamic forces can reduce the effectiveness of the procedure. This technique is studied in this paper with the Computational Fluid Dynamics (CFD), focusing on the influence of the magnetic probe position, and the direction of the circulating electric current. A single rectangular coil is used to generate the external magnetic field. A patient-specific geometry of the coeliac trunk is reconstructed from DICOM images, with the use of VMTK. A new solver, coupling the Lagrangian dynamics of the nanoparticles with the Eulerian dynamics of the blood, is implemented in OpenFOAM to perform the simulations. The resistive pressure, the Womersley's profile for the inlet velocity and the magnetic field of a rectangular coil are implemented in the software as boundary conditions. The results show the influence of the position of the probe, as well as the limitations associated with the rectangular coil configuration.

Keywords: Magnetic Hydro Dynamics, Patient-Specific, Nanoparticles, Lagrangian model, Eulerian model, Coeliac Trunk.

1. Introduction

The liver tumor results from a quick proliferation of the cells. The primary hepatic tumors, called hepatocellular tumors, are born inside the hepatic cells and spread towards bones and lungs. It is a rare condition but its mortality is quite high, as the World Health Organization has reported a number of death

☆ Nano Drug Targeting in Coeliac Trunk

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