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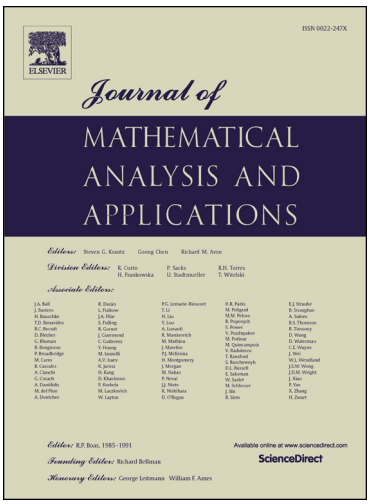


Mathematical modelling and analysis of nanoparticle gradients induced by magnetic fields

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# Mathematical modelling and analysis of nanoparticle gradients induced by magnetic fields

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**Abstract**

In this paper, we derive mathematical models for the dynamics of superparamagnetic nanoparticles under the influence of applied magnetic fields. Such models are needed in many applications, e.g. magnetic drug targeting in cancer therapy. They are the starting point for the development of stable numerical approaches and for the formulation of optimization problems, which are needed for the optimal design of magnetic field configurations. Furthermore, we show the existence and uniqueness of classical radially symmetrical solutions and illustrate their qualitative behavior by numerical simulations using Matlab.

*Keywords:* magnetic field, superparamagnetic nanoparticle, magnetic targeting, quasilinear parabolic equations, radially symmetrical solution
*2010 MSC:* : 35Q61, 35Q92, 35K20, 35K59, 35B09.

## 1. Introduction

In this paper, we are concerned with the mathematical modelling and analysis of processes in the field of magnetic targeting. Generally speaking, the aim is to control the dynamics of magnetic particles by applied magnetic fields. In our investigations, we consider superparamagnetic nanoparticles which nowadays are at the focus of many applications; here, we mention those from biomedicine.

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