深圳北理莫斯科大学
УНИВЕРСИТЕТ МГУ-ППИ В ШЭНЬЧЖЭНЕ
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应用数学讲座

Научный Семинар по Прикладной Математике

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应用数学报告（54）

报告人 / Докладчик / Speaker: 徐定华 教授 (上海财经大学)

题目 / Название / Title: Inverse Problems for DCIS Model Based on Free Boundary Value Problems

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摘要 / Аннотация / Abstract:

Mathematical modeling of tumor growth is an effective and important step in promoting knowledge about cancer, and has become one of the most attractive topics in mathematics and biology.

In this paper, we discuss two kinds of inverse problems based on deterministic and stochastic ductal carcinoma in situ (DCIS) models with free boundary conditions. First of all, based on the characteristics of deterministic DCIS model, we present an inverse problem of deterministic DCIS (IPdDCIS) under the conditions of incisional biopsy measurements at two different moments. The uniqueness solution to the IPdDCIS is proved. The IPdDCIS is transformed into a optimization problem, which is solved by particle swarm optimization method.

Since tumor concentration, boundary value functions and other parameters are inevitably affected by various random factors in the DCIS model, we mathematically formulate a kind of sDCIS model with free boundary conditions for the first time. In order to solve the sDCIS model, we construct effective numerical algorithms of an alternative iterative algorithm and random finite difference method. We establish theoretical results about the consistency and stability of the random finite difference scheme in mean square sense. The sampling finite difference scheme is presented by the Monte Carlo method to obtain statistical characteristics of numerical solutions, such as expectation and the standard deviation of numerical solutions. Based on the different types of measurement data, including incisional and needle biopsies, we propose three stochastic inverse problem for the sDCIS model. The numerical simulation results are included to demonstrate the

validity of the method and accuracy of the mathematical formulation of the IPdDCIS and the IPsDCIS.

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