On the DRBEM-FDM Solution of a Cancer Invasion Model

Gülnihal Meral

Abstract

Cancer invasion is a key factor for metastasis which is defined as the formation of a secondary tumour at distal sites. The directed movement of cancer cells is most often influenced by two mechanisms: chemotaxis and haptotaxis. The former defines the cell motion in response to the concentration of a substance called chemoattractant (or chemorepellent). However, such gradients may lack in the solution; instead, adhesive molecules could be present in increasing amount along the extracellular matrix (ECM). Since cells have to adhere to the ECM fibres in order to be able to move, they migrate from a region of low concentration of those adhesive molecules to an area with a higher concentration. This is what is called haptotaxis. In this talk, the invasion model focusing on the effect of chemotaxis and haptotaxis [1] is considered which involves the interactions between the cancer cells, the normal cells and the matrix degrading enzyme (MDE) that is secreted by the cancer cells to invade the surrounding tissue. The corresponding model consists of a system of nonlinear reaction–diffusion-transport equations and difficulties arise in the numerical solution, especially in two-dimensional case, due to the nonlinear terms in the corresponding model. The model is solved by using a combined application of finite difference and dual reciprocity boundary element methods [2]. Effects of haptotaxis, chemotaxis,proliferation of cells are analyzed using numerical solutions. The boundary only nature of DRBEM gives the advantage of obtaining consistent solution with the real phenomena using less number of discretization methods comparing with the other domain discretization methods.

****

References

[1] M.A.J. Chaplain, G. Lolas, Mathematical Modeling of Cancer Invasion of Tissue: Dynamic Heterogeneity, *Networks and Heterogeneous Media*, **1(3)** (2006) 399-439.

[2] Gülnihal Meral, DRBEM-FDM Solution of a Chemotaxis-Haptotaxis Model for Cancer Invasion, *Journal of Computational and Applied Mathematics*, doi: 10.1016/j.cam.2018.04.047.

Correspondance

gmeral@ybu.edu.tr; Department of Mathematics, Ankara Yıldırım Beyazıt University, 06010, Ankara, Turkey