Поредната сбирка на семинара на секция

Математическо моделиране и числен анализ

ще се състои на **23.04.2025 г., сряда,** от **14:00 часа** в зала **478**
на Института по математика и информатика.
Доклад на тема

Multiscale Leading Edge and Bulk Dynamics for Tumour Invasion in Fibrous Environment

ще изнесе

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Резюме: Despite all recent in vivo, in vitro, and in silico advances, the understanding of the genuine biologically multiscale process of solid tumour invasion remains one of the greatest open questions for scientific community. In this talk we present novel mathematical multiscale moving boundary modelling and structural analytical approaches for tumour invasion. Specifically, we focus on characterising mathematically key aspects of the dynamic interactions that the migratory cancer cells population and the accompanying matrix degrading enzymes (MDEs) have with the extracellular matrix (ECM) components, and in particular with the ECM fibres. These are complex interactions enabled by a series of integrated multiscale systems, which are at least two-scale in nature and share (and contribute to) the same tumour macro-dynamics (i.e., tissue-scale dynamics) but have independent-in-nature micro-dynamics (i.e., cell-scale dynamics). For instance, on the bulk of the tumour, of major interest is the dynamics of fibres degradation and structural realignment occurring at micro-scale as well as the immediate impact that this continuously changing field of oriented ECM fibres has over the tumour macro-dynamics. On the other hand, the cell-scale proteolytic micro-dynamics occurring at the tumour invasive edge interacts with the peritumoural ECM fibres through the molecular fluxes of MDEs. This interfacial cell-scale interaction not only results in changes in the micro-scale structural distribution of peritumoural ECM fibres but also influences directly the changes of the overall tumour morphology.

The new mathematical multiscale modelling framework presented here aims to address the precise biological multiscale nature of these interactions between the cancer cell population and the surrounding fibrous environment during solid tumour invasion. This involves an appropriately derived novel 2D & 3D multiscale moving boundary modelling framework as well as state-of-the-art multiscale computational approaches. Furthermore, this research paves the way for new multiscale analysis research avenues that builds on the novel concept of three-scale convergence that I established and introduced a while ago.