phagocytose the dead cells present in epithelial layer of the cervix and stimulates the reservoir DCs for maturation and enhancing the CTL production. HPV can escape such regulation by hiding within host cells to express infectivity later.

To explore the implications, we have formulated our mathematical model system and studied the model by both analytical and numerical approaches consisting of six compartments to describe the interactions between Human Papilloma Virus and three classes of cervical cells (susceptible, infected, cancerous), Dendritic cells (DC) and cytotoxic T lymphocyte (CTL). In our formulated system, we carried out local stability analysis and estimate the basic reproduction ratio(R0). Numerical studies in this system carried out to screen the regulatory role of DC in containing the cancer progression by enhancing the CTL autolytic activity.

Our results reflects new insights on the disease progression and how we could restrict the cancer development by enhancing CTL cells through interaction with DCs. Here we extend our work and formulate a set of differential equations to study the effect of chemotherapy on cancer cells of an infected individuals and simultaneously enhance the CTL killing effect. We incorporate a control strategy through drug treatment, which reduces the infected cell population studied both in implicit and explicit forms. Our study reveals that imposing the control function can reduces the cancer cell population much more efficiently.

On Homogenization of Random Attractors

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In this talk, we consider autonomous and non-autonomous 3D Navier-Stokes systems and we assume that the right–hand sides $g\left(x, \frac{x}{\varepsilon}, \omega\right)$ or $g\left(x, \frac{t}{\varepsilon}, \omega\right)$ of the systems are random functions rapidly oscillating with respect to the spatial or time variables. Here ω is an element of the standard probability space $(\Omega, \mathcal{B}, \mu)$. The parameter $\varepsilon > 0$ characterizes the oscillation frequency.

In the second part of the talk, we study asymptotic behavior of trajectory attractors of autonomous reaction-diffusion systems with randomly oscillating terms (the right-hand side and the reaction coefficient).

Along with such systems, we also consider the corresponding homogenized 3D Navier–Stokes system with external force $g^{hom}(x)$, where $g^{hom}(x)$ is the mathematical expectation of $g\left(x, \frac{x}{\varepsilon}, \omega\right)$ or $g\left(x, \frac{t}{\varepsilon}, \omega\right)$ as $\varepsilon \to 0$, and the respective homogenized reaction-diffusion system with similar terms.

We prove that the trajectory attractor $\mathfrak{A}_\varepsilon$ of the system with randomly oscillating term converges almost surely as $\varepsilon \to 0$ to the trajectory attractor $\overline{\mathfrak{A}}$ of the homogenized system in an appropriate functional space.

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Multidimensional Shock Waves, Free Boundary Problems and Nonlinear PDEs of Mixed Type

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In this talk, we discuss some of the most recent developments in the analysis of multidimensional shock waves and related free boundary problems through several longstanding fundamental shock problems in continuum mechanics. The mathematical analysis of these free boundary problems involves dealing with several core difficulties we have to face in the analysis of partial differential equations (PDEs). These include nonlinear PDEs of mixed hyperbolic-elliptic type, nonlinear degenerate elliptic PDEs, nonlinear degenerate hyperbolic PDEs, corner singularities (especially when free boundaries meet the fixed boundaries where the nonlinear PDEs experience their degeneracy), among others. These difficulties also arise in many further fundamental problems in continuum mechanics, differential geometry, mathematical physics, materials science, and other areas. Some further developments, open problems, and mathematical challenges in this direction are also addressed.

Asymptotic Expansion for the Number of Points Moving along a Metric Tree

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Let us consider a finite compact metric tree and the following dynamical system (see [1]) on it. Let one point move along the graph at the initial moment of time. If k points come to the interior vertex of valence n at the same time, then n points are released, i.e. one point corresponds to one edge. Reflection occurs in vertices of valence one. Time for passing each individual edge is fixed. The problem is to analyze the asymptotic behavior of the number $N(t)$ of such points on the graph as time t increases (see [2] for details). Such dynamical system emerges while considering the Cauchy problem for the time-dependent Schrödinger equation on hybrid spaces