Controllability of reaction-diffusion system of partial differential equations

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Abstract

Mathematically, reaction-diffusion systems can be written in the form of a system of semi-linear parabolic partial differential equations as:

$$u_t = D_u \Delta u + f_u(u, v)$$
$$v_t = D_v \Delta v + g_v(u, v)$$

where D_u, D_v are positive constants called diffusion coefficients and f_u and g_v describes local reactions. The reaction-diffusion system described here involves two generic chemical species U and V, whose concentration at a given point in space is referred to by the variables u and v. As the term implies, they react with each other, and they diffuse through the medium. Therefore, the concentrations of U and V at any given location change over time and can differ from those at other locations following the laws of the equation.

In this talk, we discuss the controllability of a few reaction-diffusion systems (i) the Gray-Scott system. (ii) Chemotaxis parabolic-elliptic system (iii) Generalized Burgers-Huxley equation

These are joint works with my PhD students, Dr MM Bapu and Mr Aman Patel.

I will also mention the second direction of my work (jointly done with Prof. Suprio Bhar and PhD student Mr Mangala Prasad) on Numerical approximations of stochastic PDEs.