Abstract

In this talk, I will provide a brief detail of my thesis work, where we have explored the dynamics of wave patterns of the excitable media. This work is mainly concerned with the High Order Compact (HOC) simulation of spiral waves in excitable media in general and study of spiral wave dynamics in particular. An existing unconditionally stable, $O(h^4, (\Delta t)^2)$ implicit HOC scheme for the two dimensional convection-diffusion equations is reconstructed to discretize some of the very well-known models of pattern formation in excitable media, notable amongst them are the Barkley and the FHN models. Contrary to the usual practice of using state variables solely to explore the dynamics of spiral waves, the spiral wave tip is used as a major tool to study the same. Our study reveals that while the use of the tip leads to accurate prediction of the dynamics, many a time, sole use of the state variables bring about misleading conclusions. Further, the effect of an obstacle on the dynamics of periodic rotating spiral waves is studied. The reconstructed HOC scheme is then employed to the Oregonator model to study the effect of straining on the stable rotating spiral wave. Finally, a dual-purpose implicit, unconditionally stable HOC scheme is developed to discretize the 3D unsteady R-D equations, which is seen to resolve both 3D reaction-diffusion and convection-diffusion equations with equal ease.

Further, I will state the possible research problems which I would like to carry out at IISER Thiruvananthapuram.