Existence and description of attractors for systems of parabolic equations

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In this talk we shall present some results regarding the attractors of certain systems of parabolic equations. These include the FitzHugh–Nagumo equations and the Olmstead et al. model for the flow of a non–Newtonian fluid in the presence of memory.

The emphasys will be on conditions for the existence of a Lyapunov functional, the existence of periodic behaviour, and the stability of stationary solutions. Regarding the latter, we introduce a scalar parabolic equation with the same set of stationary solutions as the original system, and with the property that the dimension of the unstable manifold for a given stationary solution for the system is always greater than or equal to that of the corresponding solution of the reduced equation. Conditions given equality of the two dimensions are also presented.

The talk will be mainly based on the following articles

- B. R. Duffy, P. Freitas and M. Grinfeld, Memory driven instability in a diffusion process, SIAM J. Math. Anal. 33 (2002), 1090–1106.
- P. Freitas, Eigenvalue problems for the wave equation with strong damping, Proc. Roy. Soc. Edinburgh A 127 (1997), 755–771.
- P. Freitas and C. Rocha, Lyapunov functionals and stability for FitzHugh– Nagumo systems, J. Differential Equations 169 (2001), 208–227.