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Analysis of instabilities and pattern formation in time fractional reaction-diffusion systems

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We analyzed conditions for Hopf and Turing instabilities to occur in two-component fractional reaction-diffusion systems. We showed that the eigenvalue spectrum and fractional derivative order mainly determine the type of instability and the dynamics of the system. The results of the linear stability analysis are confirmed by computer simulation of the model with cubic nonlinearity for activator variable and linear dependance for the inhibitor one. It is shown that pattern formation conditions of instability and transient dynamics are different than for a standard system. As a result, more complicated pattern formation dynamics takes place in fractional reaction-diffusion systems.

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