On modelling self-organisation in real systems

Vaclav Kilka

Czech Technical University in Prague

Nowadays models for self-organisation are being used in systems with a great degree of complexity and across disciplines. We show that the used Turing model is sensitive to parameters, type of domain growth, but also to the precision of model formulation itself. Hence it is necessary to revise Turing's model for self-organisation. For this purpose we consider derivation of evolution equations within non-equilibrium thermodynamic to identify physically relevant formulations. Only then we subject these models to a detailed mathematical analysis. We offer possible extensions of the concept of self-organisation to more general situations and discuss its physical interpretation.

The essence and importance of these ideas is illustrated on the reaction-diffusion-advection system, where we indicate that such a system should be preferred from both physical and mathematical viewpoint. Further we point to the indispensable role of physical viewpoint during relevant model formulations. Using the non-equilibrium thermodynamic framework physically consistent extensions of Turing model are revealed as well as functional constraints for present parameters.