Computational Modelling of Nonlinear Structure Development Phenomena over Complex Geometries and Topologies

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Abstract: The spatial structure evolution of multi-component systems governed by diffusion-driven phase separation, including new extended 2-scale models constitutes the first group of problems studied. The study refers to applications in structured populations and heterogeneous materials. Phase-field systems, arising from modelling of processes with a phase change or ordering change, represent the second class of problems considered.

For the two classes of problems, results on the appropriate developments over complex geometries and complex topology of the domains will be reported. The case of time-variable geometries will also be admitted, including sensitivity analysis for characteristic classes of the parametrized domain variations.

The impact of temporal topology changes will be discussed, including large-time developments as dependent upon local perturbations of model parameters and data. It is to note that the case of geometric domains of high complexity is ruled out in most of the existing studies to the benefit of rather simple, regular domains.

Going beyond computational studies, the report will also address some of the qualitative features such as an impact of local data variations on system behaviour at distant locations, in particular the nature of large-time developments in systems locally activated and the resulting structure variations of the equilibrium states.

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