Nonlinear evolution equations with applications to reaction-diffusion systems

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Reaction-diffusion systems with nonlinear diffusion often admit an abstract formulation as evolution problems of type

$$u' + Au \ni f(t,u) \quad \text{on } J=[0,a],\ u(0)=u_0$$

with m-accretive A and continuous or Carathéodory f in appropriately chosen Banach spaces. We explain the fundamental ideas and techniques to prove existence of mild solutions, where a fixed point approach is employed in case f is everywhere defined, while carefully chosen approximate solutions are required if f is only defined on closed subsets or, more generally, on the graph of a tube. The latter allows for existence results under time-dependent constraints which are shown to be helpful in applications of the abstract theory to specific reaction-diffusion systems.