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Well-posedness for a class of nonlinear SPDEs with strongly continuous perturbation

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SUMMARY

We consider the stochastic evolution equation

$$du - \nabla(a(x, u, Du) + F(u))dt = \Phi \, dW$$

for $T > 0$, on a bounded Lipschitz domain D with homogeneous Dirichlet boundary conditions and initial condition in $L^2(D)$. The main technical difficulties arise from the nonlinear diffusion-convection operator which is defined by a Carathéodory function $a = a(x, \lambda, \xi)$ satisfying appropriate growth and coercivity assumptions and $F : \mathbb{R} \to \mathbb{R}^d$ Lipschitz continuous. On the right-hand side, we consider an additive stochastic perturbation with respect to a cylindrical Wiener process with values in $L^2(D)$. We obtain approximate solutions by a semi-implicit time discretization. Adjusting the method of stochastic compactness to our setting, we are able to pass to the limit in the approximate equation. We show an L^1-contraction principle and obtain existence and uniqueness of (stochastically) strong solutions.

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