Decoupled operator preconditioning for the numerical solution of nonlinear convection-reaction-diffusion systems

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Nonlinear convection-reaction-diffusion systems arise in the modelling of various transport type phenomena. Time discretization or the study of stationary states lead to nonlinear elliptic systems consisting of several partial differential equations. We consider the outer-inner iterative solution of such systems using outer damped inexact Newton and inner preconditioned conjugate gradient iterations. The key of this method is the proper preconditioning, for which we propose decoupled, i.e. independent preconditioning operators. The method is applied to a test problem in air pollution modelling.