On PCD preconditioner for Navier-Stokes equations

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We provide a novel analysis for the pressure convection-diffusion (PCD) preconditioner for the incompressible Navier-Stokes equations. We first develop a theory for the preconditioner considered as an operator in infinite-dimensional spaces. We then provide a methodology for constructing discrete PCD operators for a broad class of pressure discretizations. The principal contribution of the work is that a clear and pronounced methodology for dealing with the artificial boundary conditions is given, including the inflow-outflow case, which has not been adequately addressed in the existing literature. In particular, new forms of discrete PCD are derived, which are, unlike the previously published variants, proven to be invertible and robust in data.

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