A parallel-in-time solver for nonlinear degenerate time-periodic parabolic problems

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We consider a class of abstract nonlinear time-periodic evolution problems which arise in electrical engineering and other scientific disciplines. We propose an efficient solver for the systems arising after discretization in time based on a fixed-point iteration. Every step of this iteration amounts to the solution of a discretized time-periodic and time-invariant problem for which efficient parallel-in-time methods are available. We establish global convergence with contraction factors independent of the discretization parameters. Together with an appropriate initialization step, we obtain

a highly efficient and reliable solver. We illustrate the applicability and performance of the proposed

method by simulations of a power transformer, where we further compare with other solution strategies proposed in the literature.