Discrete time analysis for domain decomposition

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Optimized Schwarz waveform relaxation (OSWR) is a domain decomposition algorithm for solving partial differential equations on small subdomains in order to accelerate numerical resolution. This poster shows a new approach that provides new results in the convergence analysis of OSWR iterations for parabolic problems.

This new approach relies on the time discretization of the domain decomposition equations with backward Euler, in order to obtain a system of differential equations that can be analytically solved. Contrary to the classical method that choses the Robin parameter that minimizes the contraction ratio of the Fourier transform of the continuous in time solution, this method minimizes the contraction matrix norm of the discrete time solution.

This method allows to define efficient optimized Robin parameters that depend on the targeted iteration count, a property that is shared by the actual observed optimal parameters, while traditional Fourier analysis in the time direction leads to iteration independent parameters. Numerical results show that this parameter is an accurate estimation of the optimal Robin parameter, which allows to perform the smallest number of iterations possible.