1056-65-1445 **Martin Gander** (gander@math.unige.ch), Section de Mathématiques, Université de Genève, CP 64, CH-1211 Geneva, Switzerland, **Sébastien Loisel** (loisel@math.unige.ch), Section de Mathématiques, Université de Genève, CP 64, CH-1211 Geneva, Switzerland, and **Daniel B Szyld*** (szyld@temple.edu), Department of Mathematics, Temple University (038-16), 1805 N. Broad Street, Philadelphia, PA 19122. *Very fast methods and preconditioners for banded matrices and PDEs on irregular domains.*

Optimized Schwarz methods (OSM) and preconditioners subdivide the domain of a partial differential equation (PDE) into subdomains and use Robin transmission conditions at the artificial interfaces, and the Robin parameter can be optimized so that the resulting iterative method has an optimal convergence rate.

We present a completely algebraic view of OSM, including an algebraic approach to find the optimal operator or a sparse approximation thereof. This allows us to apply this method to any banded or block banded linear system of equations, and in particular to discretizations of PDEs on irregular domains.

With the computable optimal operator, we prove that the OSM converges in two iterations for the case of two subdomains. Similarly, we prove that when we use an Optimized Schwarz preconditioner with this optimal parameter, the underlying minimal residual Krylov subspace method converges in two iterations. Very fast convergence is attained even when the optimal operator is approximated by a sparse transmission matrix.

Numerical examples illustrating these results both for the additive and multiplicative case are presented. (Received September 21, 2009)