**ICM-9105-08** SOR-like Methods for Lyapunov Matrix Equations, Gerhard Starke, Proceedings of the IMACS International Symposium on Iterative Methods in Linear Algebra, Brussels, 1991, p. 233-240.

ABSTRACT: We introduce and analyze a new method for the iterative solution of Lyapunov matrix equations $AX + XA^T = C$. This method is a combination of the SOR method — which can be defined for matrix equations $AX - XB = C$ via the block SOR method applied to the equivalent large linear system $(A \otimes I_n - I_m \otimes B^T)\mathbf{x} = \mathbf{c}$ and the idea of alternating directions — the ADI method applied to this large linear system leads to another iterative technique which is known as Smith's method. Numerical results indicate that this alternating direction SOR method converges in cases when SOR diverges — which is often the case for non-normal $A$ — and that its convergence behavior is comparable to that obtained with the ADI method.