

NUMERICAL ANALYSIS AND SCIENTIFIC COMPUTING
SEMINAR

*Truncating low-rank preconditioner updates for sequences of
linear systems*

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Abstract: In many applications, we need to solve sequences of large linear systems. If good preconditioners are required for fast convergence, we may need to compute many preconditioners. This can be very expensive. One could compute a single preconditioner for all systems or recompute the preconditioner infrequently, but this may lead to very large number of iterations. An alternative is to update the preconditioner in some efficient manner while maintaining the quality of the preconditioner. One such approach is to update the preconditioner by low-rank updates, typically applied in a multiplicative way, which can be done very cheaply. However, this has the problem that applying the preconditioner (during the iterative solve) gets increasingly expensive. We discuss two methods to truncate such low-rank updates while maintaining good preconditioner quality. We give applications from solid state physics and nonlinear partial differential equations.

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