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The omega-condition number for optimal preconditioning of linear systems

Preconditioning is essential in iterative methods for solving linear systems. It is also the implicit objective in updating approximations of Jacobians in optimization methods, e.g., in quasi-Newton methods. We study a nonclassic matrix condition number, the *omega*-condition number, the ratio of the arithmetic and geometric means of the singular values. We do this in the context of optimal conditioning for: (i) low rank updating of generalized Jacobians; (ii) iterative methods for linear systems: (iia) clustering of eigenvalues and (iib) convergence rates. In particular, we show the advantages over the classical kappa-condition number. (work with Woosuk L. Jung and David Torregrosa-Gelén)