

# WHAT PART OF A NUMERICAL PROBLEM IS ILL-CONDITIONED?

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Many numerical problems with input  $x$  and output  $y$  can be formulated as an system of equations  $F(x, y) = 0$  where the goal is to solve for  $y$ . The condition number measures the change of  $y$  for small perturbations to  $x$ . From this numerical problem, one can derive a (typically underdetermined) subproblem by omitting any number of constraints from  $F$ . We propose a condition number for underdetermined systems that relates the condition number of a numerical problem to those of its subproblems. We illustrate the use of our technique by computing the condition of two numerical linear algebra problems that do not have a condition number in the classical sense: the decomposition of a low-rank matrix into unstructured factors and Tucker decomposition.

*Joint work with Nick Vannieuwenhoven (KU Leuven, Belgium).*