On Level-2 Condition Numbers

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Summary. Condition numbers are a classical theme in numerical analysis. They occur as a parameter in bounds for both complexity and round-off error analysis. For problems whose output varies continuously as a function of the input, condition numbers measure "the worst-case sensitivity to small perturbations."

Any problem induces another problem namely, the computation of its condition number. Two natural questions arising from this remark are: how difficult is to compute the condition number? and, how sensitive is this computation? Renegar conjectured that computing a condition number $C(d)$ for a data d is as difficult as solving the original problem with input d.

Our talk focuses on the second question. This can be restated as, what is the condition number of d for the function $d \to C(d)$? This "condition of the condition", called level-2 condition number was introduced by J. Demmel.

We prove that for a large class of problems, including those with a discrete set of inputs, their level-2 condition number (essentially) coincides with the original one.

[Joint work with Dennis Cheung]