

Condition Numbers

Absolute Condition Number

Let $f : V \rightarrow W$, V, W vector spaces with norms.

For a given $\delta > 0$,

$$\kappa_\delta := \sup_{\delta x \in V, 0 < \|\delta x\| \leq \delta} \frac{\|f(x + \delta x) - f(x)\|}{\|\delta x\|}.$$

Relative Condition Number

Let $f : V \rightarrow W$, V, W vector spaces with norms.

For a given $\delta > 0$,

$$\tilde{\kappa}_\delta := \sup_{\delta x \in V, 0 < \|\delta x\| \leq \delta} \frac{\|f(x + \delta x) - f(x)\| / \|f(x)\|}{\|\delta x\| / \|x\|}$$

Relative Condition Number

Let $f : V \rightarrow W$, V, W vector spaces with norms.

For a given $\delta > 0$,

$$\begin{aligned}\tilde{\kappa}_\delta &:= \sup_{\delta x \in V, 0 < \|\delta x\| \leq \delta} \frac{\|f(x + \delta x) - f(x)\| / \|f(x)\|}{\|\delta x\| / \|x\|} \\ &= \frac{\|x\|}{\|f(x)\|} \kappa_\delta.\end{aligned}$$