

Finite-Difference Summary

Beyond Accuracy Issues, Finite-Difference Methods Are Expensive

In order to evaluate ∇f when $x \in \mathbb{R}^n$,

- the forward-difference approximation requires n function evaluations, not including the unperturbed value $f(x)$;
- the central-difference approximation requires $2n$ function evaluations.

Pros & Cons of Finite-Difference Approximations

- ✓ easy to implement
- ✓ can be applied to almost any “black-box” software
- ✗ accuracy can be an issue, especially for badly scaled problems; also, choosing h^* may be difficult for multiple design metrics
- ✗ computational cost scales with the # of design variables