Optimization: Basic Ideas

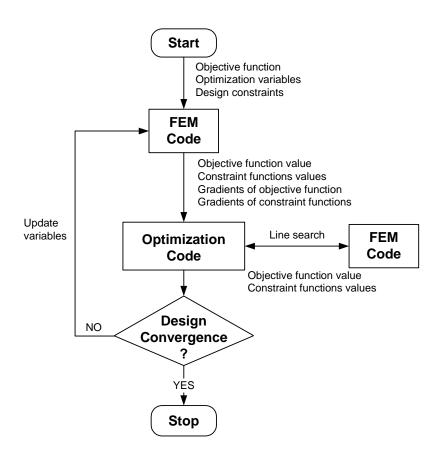
Problem Definition: Three basic steps

- 1. Definition of *optimization variables*: $x \in \mathbb{R}^n$
- 2. Definition of a cost or many cost functions: minimize f(x)
- 3. Constraints equalities and/or inequalities: $h_i(x) = 0$; $g_j(x) \le 0$ **Notes**: Constraints and variables should be normalized for better computational performance. Functions f(x), $h_i(x)$, and $g_j(x)$ could be explicit in terms of variables x, or implicitly depend on x.

Computational Algorithm:
$$x^{(k+1)} = x^{(k)} + \alpha_k d^{(k)}$$
; $k = 0,1,2...$

Two subproblems need to be solved:

- 1. Search direction $d^{(k)}$ determination: needs functions and gradients.
- 2. Step size α_k calculation in the direction $d^{(k)}$: needs function values.



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