* Método dos gradientes conjugados para funções não quadráticas.

- Anteriormente

(Funções quadráticas) $f(x) = x^T A x + b^T \cancel{x} + c$

Dado $x_0 \in \mathbb{R}^n$, faça $d^0 = -\nabla f(x_0)$

$K = 0$

Repita enquanto $\nabla f(x^k) \neq 0$

$$t_k = - \frac{\nabla f(x^k)^T d^k}{(d_k)^T A d^k}$$

$$x_{k+1} = x_k + t_k d^k$$

$$\beta_k = \frac{(d^k)^T A \nabla f(x^{k+1})}{(d^k)^T A d^k}$$

$$\nabla f(x^{k+1}) = A(x^k + t_k d^k) + b = \nabla f(x^k) + t_k A d^k$$

$$A d^k = \frac{\nabla f(x^{k+1}) - \nabla f(x^k)}{t_k}$$

$$\beta_k = \frac{(d^k)^T A \nabla f(x^{k+1})}{(d^k)^T A d^k} = (A \nabla f(x^{k+1}) d_k)^T$$

$$\beta_k = \frac{(d^k)^T A \nabla f(x^{k+1})}{\frac{(d^k)^T(\nabla f(x^{k+1}) - \nabla f(x^k))}{T_k}}$$

$\beta_k =$

Dado $x_0 \in \mathbb{R}^n$, faça $d^0 = -\nabla f(x_0)$

$k = 0$

Repita enquanto $\nabla f(x^k) \neq 0$

Calcule t_k

$x^{k+1} = x^k + t_k d^k$

se $(k+1) \bmod n \neq 0$

$\beta_k = \ldots$

senão

$\beta_k = 0$

$d_{k+1} = -\nabla f(x^{k+1}) + \beta_k d_k$

$k = k+1$

$$A d_k$$
$$= \left((A d_k)^T \right)^T$$
$$= \left(d_k^T A^T \right)^T$$

$$d_k^T A$$
$$= \left((d_k^T A)^T \right)^T$$
$$= \left(A^T d_k \right)^T$$
$$= (A d_k)^T$$
$$= \left(\left((g_{k+1} - g_k)^T g_{k+1} \right)^T \right)^T$$
$$\left(g_{k+1}^T (g_{k+1} - g_k) \right.$$

$$\begin{bmatrix} a & b \end{bmatrix} \begin{bmatrix} c & d \\ e & f \end{bmatrix} \begin{bmatrix} g \\ h \end{bmatrix}$$

$$\begin{bmatrix} ac + be & ad + bf \end{bmatrix} \begin{bmatrix} g \\ h \end{bmatrix} = \begin{matrix} g(ac+be) \\ + \\ h(ad+bf) \end{matrix}$$

$$= gac + gbe + had + hbf$$

$$\begin{bmatrix} c & d \\ e & f \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = ac + bd, \; ae + fb$$

$$[gh]$$

$$\begin{bmatrix} g & h \end{bmatrix} \begin{bmatrix} c & d \\ e & f \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix}$$

$$\begin{bmatrix} gc + he, & gd + fh \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{matrix} a(gc + he) + \\ b(gd + fh) \end{matrix}$$

$$\left((A d^k)^T\right)^T$$

$$= \left((d^k)^T A^T\right)^T$$

$$=$$

$$A d^k$$

$$A d^k$$

$$= \left((A d^k)^T\right)^k$$

$$gac + hea + abd + hbf$$