A CONJUGATE DIRECTIONS METHOD OF WOLFE (1975)

$F(x)$: $\mathrm{R}^n \rightarrow \mathrm{R}$ convex and nondifferentiable

At iteration k :

Let $G^{(k} = \{\ z^{(k},\ z^{(k-1},\ .\ .\ .\ \}$; $a_k = \sum_{l \le k} \left\| x^{(l} - x^{(l-1} \right\|_2$

- **Approximate Demjanov's gradient using columns in $G^{(k}$:**

Solve $\quad Min \quad \alpha^T G^T G\, \alpha$

s.t. $\sum_i \alpha_i = 1, \quad \alpha_i \ge 0 \rightarrow \alpha^*$

$$d^{(k} = -\sum_{z_i \in G^{(k}} \alpha_i^* z_i$$

- **If** $\left\| d^{(k} \right\|_2 < \varepsilon$ **then**

  If $a_k \le \delta$ **then** *STOP:* $\boxed{x^{(k} \approx x^*}$

  If $a_k > \delta$ **then** *RESET*: $x^{(k+1} = x^{(k}$; $a_{k+1} = 0$; $G^{(k} = \{\ g_k\ \}$

- **If** $\left\| d^{(k} \right\|_2 \ge \varepsilon$ **then**

- Line search : $x^{(k+1} = x^{(k} + \beta\, d^{(k}$; $a_{k+1} = a_k + \left\| x^{(k+1} - x^{(k} \right\|_2$

- Evaluate $g_{k+1} \in \partial F(x^{(k+1})$

- Update $G^{(k}$**: Add {** $-d^{(k}, g_{k+1}$ **} and drop the oldest columns.**

- $k \leftarrow k+1$