Algorithm 1: Richardson's method

$\boldsymbol{x}_0$ given
$\boldsymbol{r}_0 = \boldsymbol{b} - \boldsymbol{A}\,\boldsymbol{x}_0$
$\boldsymbol{k} = \boldsymbol{0}$
repeat
- $\boldsymbol{p}_k = \boldsymbol{r}_k$
- $\boldsymbol{\alpha}_k = \boldsymbol{\tau}$
- $\boldsymbol{x}_{k+1} = \boldsymbol{x}_k + \boldsymbol{\alpha}_k\,\boldsymbol{p}_k$
- $\boldsymbol{r}_{k+1} = \boldsymbol{r}_k - \boldsymbol{\alpha}_k\,\boldsymbol{A}\,\boldsymbol{p}_k \qquad = \boldsymbol{b} - \boldsymbol{A}\,\boldsymbol{x}_{k+1}$
- $\boldsymbol{k} = \boldsymbol{k} + \boldsymbol{1}$

until *stopping criterion fulfilled, e.g.* $\|\boldsymbol{r}_k\|_{\ell^2} \leq \varepsilon\,\|\boldsymbol{r}_0\|_{\ell^2}$

Algorithm 2: Method of steepest descent

$\boldsymbol{x}_0$ given
$\boldsymbol{r}_0 = \boldsymbol{b} - \boldsymbol{A}\,\boldsymbol{x}_0$
$\boldsymbol{k} = \boldsymbol{0}$
repeat
- $\boldsymbol{p}_k = \boldsymbol{r}_k$
- $\boldsymbol{\alpha}_k = \frac{(\boldsymbol{r}_k,\boldsymbol{p}_k)}{(\boldsymbol{A}\,\boldsymbol{p}_k,\boldsymbol{p}_k)}$
- $\boldsymbol{x}_{k+1} = \boldsymbol{x}_k + \boldsymbol{\alpha}_k\,\boldsymbol{p}_k$
- $\boldsymbol{r}_{k+1} = \boldsymbol{r}_k - \boldsymbol{\alpha}_k\,\boldsymbol{A}\,\boldsymbol{p}_k \qquad = \boldsymbol{b} - \boldsymbol{A}\,\boldsymbol{x}_{k+1}$
- $\boldsymbol{k} = \boldsymbol{k} + \boldsymbol{1}$

until *stopping criterion fulfilled, e.g.* $\|\boldsymbol{r}_k\|_{\ell^2} \leq \varepsilon\,\|\boldsymbol{r}_0\|_{\ell^2}$

Algorithm 3: Conjugate gradient method

$\boldsymbol{x}_0$ given
$\boldsymbol{r}_0 = \boldsymbol{b} - \boldsymbol{A}\,\boldsymbol{x}_0$
$\boldsymbol{k} = \boldsymbol{0}$
repeat
- **if** $\boldsymbol{k} = \boldsymbol{0}$ **then**
  - $\boldsymbol{p}_k = \boldsymbol{r}_k$
- **else**
  - $\boldsymbol{\beta}_{k-1} = -\frac{(\boldsymbol{r}_k,\boldsymbol{A}\,\boldsymbol{p}_{k-1})}{(\boldsymbol{p}_{k-1},\boldsymbol{A}\,\boldsymbol{p}_{k-1})}$
  - $\boldsymbol{p}_k = \boldsymbol{r}_k + \boldsymbol{\beta}_{k-1}\,\boldsymbol{p}_{k-1}$
- **end**
- $\boldsymbol{\alpha}_k = \frac{(\boldsymbol{r}_k,\boldsymbol{p}_k)}{(\boldsymbol{A}\,\boldsymbol{p}_k,\boldsymbol{p}_k)}$
- $\boldsymbol{x}_{k+1} = \boldsymbol{x}_k + \boldsymbol{\alpha}_k\,\boldsymbol{p}_k$
- $\boldsymbol{r}_{k+1} = \boldsymbol{r}_k - \boldsymbol{\alpha}_k\,\boldsymbol{A}\,\boldsymbol{p}_k \qquad = \boldsymbol{b} - \boldsymbol{A}\,\boldsymbol{x}_{k+1}$
- $\boldsymbol{k} = \boldsymbol{k} + \boldsymbol{1}$

until *stopping criterion fulfilled, e.g.* $\|\boldsymbol{r}_k\|_{\ell^2} \leq \varepsilon\,\|\boldsymbol{r}_0\|_{\ell^2}$