Algorithm 1.38: PCG

Initialization:

Choose initial guess $u^0 \in \mathbb{R}^n$, e.g. $u^0 = C^{-1} f$

$d^0 = f - K u^0$

Iteration:

FOR $n = 0$ **STEP** 1 **UNTIL** convergence **DO**

$$w^n = C^{-1} d^n \quad \text{(preconditioning)}$$

$$p^n = \begin{cases} w^0 & \text{for } n = 0 \\ w^n + \beta^{(n-1)} p^{n-1}, \text{ with } \beta^{(n-1)} = \dfrac{(d^n, w^n)}{(d^{n-1}, w^{n-1})} & \text{for } n \geq 1 \end{cases}$$

$$u^{n+1} = u^n + \alpha^{(n)} p^n, \text{ with } \alpha^{(n)} = \frac{(d^n, w^n)}{(K p^n, p^n)},$$

$$d^{n+1} = d^n - \alpha^{(n)} K p^n$$

ENDFOR

Generalization to the Non-SPD-case:

- Krylov-subspace-methods like GMRES = Generalized Minimum RESidual method see Lecture Notes NuPDE, pp. 44-46
- Literature:

1. O. Steinbach: Lösungsverfahren für lineare Gleichungssysteme: Algorithmen und Anwendungen. Teubner-Verlag, Wiesbaden 2005.
2. G. Meurant: Computer Solution of Large Linear Systems. Studies in Mathematics and its Applications. 28, North-Holland, Amsterdam, 1999.
3. Y. Saad: Iterative Methods for Sparse Linear Systems. 1995.