

# Preconditioned Conjugate Gradient (PCG) Method:

## PCG - Algorithms:

### Startschritt:

$$x^{(0)} \in \mathbb{R}^n - \text{geg. Startnäher., z.B. } x^{(0)} = C^{-1}b$$

$$d^{(0)} := b - Ax^{(0)}$$

$$w^{(0)} := C^{-1} \cdot d^{(0)}$$

$$s^{(0)} := w^{(0)}$$

### Iteration: $k=0, 1, \dots$ (Konvergenztest)

$$\text{Test: } (w^{(k)}, d^{(k)}) \leq \varepsilon^2 (w^{(0)}, d^{(0)})$$

$$\|z^{(k)}\|_{AC^{-1}A} \leq \varepsilon \|z^{(0)}\|_{AC^{-1}A} \quad \text{(norm)}$$

$$\alpha^{(k+1)} := \frac{(d^{(k)}, s^{(k)})}{(As^{(k)}, s^{(k)})} = \frac{(d^{(k)}, w^{(k)})}{(As^{(k)}, s^{(k)})} \quad \text{(norm)}$$

$$x^{(k+1)} := x^{(k)} + \alpha^{(k+1)} s^{(k)}$$

$$d^{(k+1)} := d^{(k)} - \alpha^{(k+1)} As^{(k)}$$

$$w^{(k+1)} := C^{-1} \cdot d^{(k+1)}$$

$$\beta^{(k+1)} := \frac{(Aw^{(k+1)}, s^{(k)})}{(As^{(k)}, s^{(k)})} = \frac{(w^{(k+1)}, d^{(k+1)})}{(w^{(k)}, d^{(k)})} \quad \text{(norm)}$$

$$s^{(k+1)} := w^{(k+1)} + \beta^{(k+1)} s^{(k)}$$