

$\text{durch } e_i$

$$\begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{pmatrix} = \begin{pmatrix} b_1 \\ b_2 \\ \vdots \\ b_m \end{pmatrix} \quad \begin{pmatrix} p \\ \vdots \\ 0 \end{pmatrix}$$

$$A \cdot (Ax + Bx) = A(Ax) + A(Bx) = 0$$

$$\left. \begin{array}{c} \\ \\ \end{array} \right\} h(A)$$

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$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \\ x_8 \\ x_9 \end{pmatrix} = \begin{pmatrix} \dots \\ \dots \end{pmatrix}$$

$$1) \quad x_4 + 2x_5 = 0 \Rightarrow x_4 = -2x_5$$

$$2x_1 + x_2 + x_3 = 0$$

$$2x_2 + x_3 - 2x_4 = 0$$

$$\Rightarrow x_2 = x_3 - \frac{1}{2}x_4$$

$$x_1 + x_3 = 0$$

$$\Rightarrow x_1 = -x_3$$

$$2) \quad x_5 = 0 \quad x_3 = 1 \Rightarrow \begin{pmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} -1/2 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} -1 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

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$$A \cdot x = b \quad A = (u_1, u_2, \dots, u_n)$$

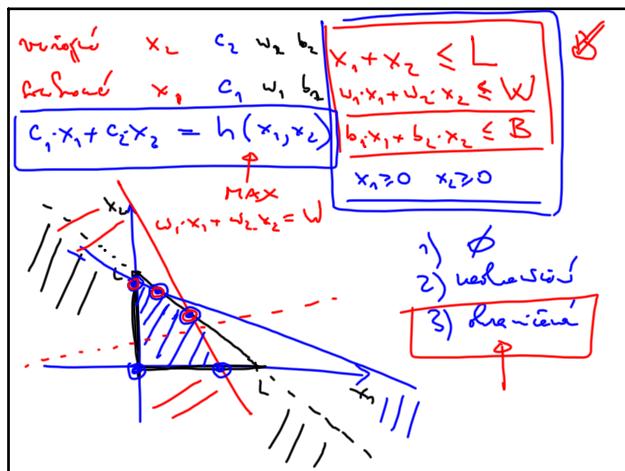
$$A \cdot x = x_1 u_1 + x_2 u_2 + \dots + x_n u_n$$

$$\Rightarrow b \text{ ist kein Linearkombination von } u_1, u_2, \dots, u_n$$

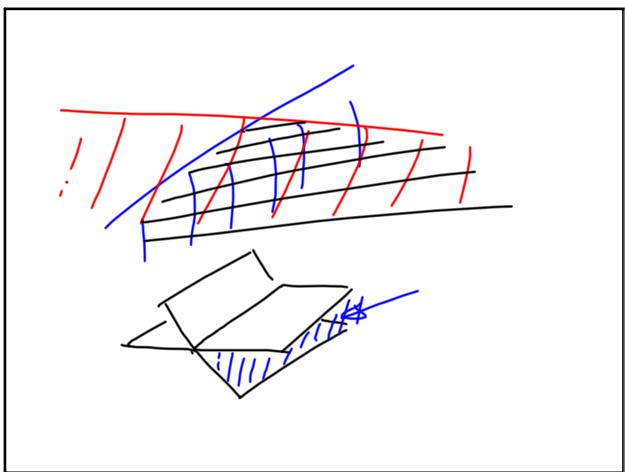
$$(A|b) = (u_1, u_2, \dots, u_n | b)$$

$$\text{a)} \quad \left(\begin{array}{c|c} \dots & \dots \\ \dots & \dots \end{array} \right) \quad \text{b)} \quad \left(\begin{array}{c|c} \dots & \dots \\ \dots & \dots \end{array} \right)$$

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$$A \cdot x \leq b \quad z = c \cdot x$$

$$\left\{ \begin{pmatrix} 1 & -c & 0 \\ 0 & A & E_m \end{pmatrix} \cdot \begin{pmatrix} z \\ x \\ x_s \end{pmatrix}_m = \begin{pmatrix} 0 \\ b \end{pmatrix} \right.$$

$$c \cdot x = z$$

$$A \cdot x + x_s = b$$

$$\begin{pmatrix} x \geq 0 \\ x_s \geq 0 \end{pmatrix}$$

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Durchl & vektör Elbow:

$$\begin{aligned}\varphi: V \rightarrow V & \quad \varphi(\alpha) = \alpha \cdot m \\ A: x \mapsto A \cdot x & \quad (A - \alpha E) \cdot x = 0 \\ |A - \alpha E| = 0 \Rightarrow \lambda &= \text{reelle Eigenwerte} \\ \text{dim } V = n & \quad \lambda_1, \dots, \lambda_n \text{ sind vektör Elbow} \\ \Rightarrow \exists v_1, \dots, v_n \text{ basis } V, \text{ s.t. } \lambda_i & \text{ ist } v_i \text{ reelle} \\ \tilde{A} = \begin{pmatrix} \lambda_1 & 0 \\ 0 & \ddots \\ 0 & 0 \end{pmatrix} &\end{aligned}$$

$$\lambda_{1,2} = a \pm ib \quad \mathbb{R}^n \subset \mathbb{C}^n$$

$$x \mapsto A \cdot x$$

$$\begin{aligned}\begin{pmatrix} 0 & 1 & 0 & \dots & 0 \\ 0 & 0 & 2 & \dots & 0 \\ 0 & 0 & 0 & \dots & n \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \dots & 0 \end{pmatrix} & \begin{aligned}(a_n x^n + \dots + a_0)' \\ = n a_n x^{n-1} + \dots + a_1 + 0 \\ x^n \mapsto n \cdot x^{n-1} \\ \mapsto n(n-1)x^{n-2} \\ \vdots \\ \mapsto \dots 0\end{aligned} \\ \text{if } \begin{pmatrix} \lambda & 1 & 0 & \dots & 0 \\ 0 & \lambda & 2 & \dots & 0 \\ 0 & 0 & \lambda & \dots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \dots & \lambda \end{pmatrix} & = (-1)^{n+1} \cdot \lambda^{n+1} \\ (\varphi - \lambda \text{id})|_{V_i} &\end{aligned}$$

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