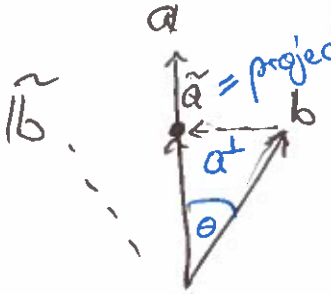
$c := \cos\theta$
$s := \sin\theta$

book p.115

$$Rot = \begin{pmatrix} c & -s \\ s & c \end{pmatrix}$$

$$\begin{pmatrix} c & -s \\ s & c \end{pmatrix}^{-1} = \frac{1}{c^2+s^2}\begin{pmatrix} c & s \\ -s & c \end{pmatrix} = \begin{pmatrix} c & s \\ -s & c \end{pmatrix} = \begin{pmatrix} c & -s \\ s & c \end{pmatrix}^T$$



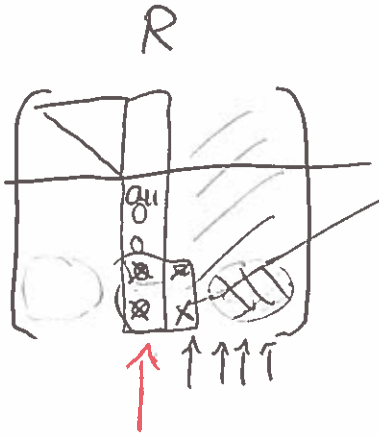
$$\tilde{a} = \|b\|\cos(\theta)\frac{a}{\|a\|} = \frac{a\cdot b}{\|a\|\,\|b\|}\frac{a}{\|a\|}$$

$$a^\perp = \tilde{a} - b$$

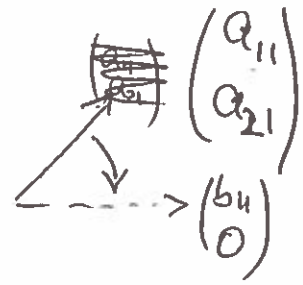
$$\tilde{b} = b + 2a^\perp = 2\tilde{a} - b$$

reflection of b across a

$$\tilde{b} = 2\frac{a\cdot b}{\|a\|\|a\|}a - b$$



$$G \cdot \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} = \begin{pmatrix} b_1 & b_{12} \\ 0 & b_{22} \end{pmatrix}$$



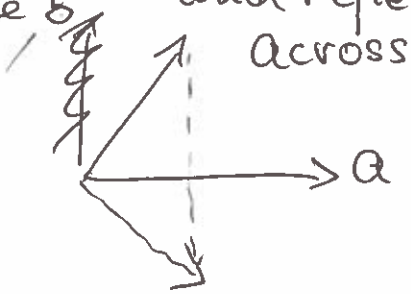
$G^T G$ = Identity

Givens Rotations

$$H \cdot$$

$$-\alpha \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

choose b and reflect across a



Householder Transformation

$$\underbrace{H_{n-1} \cdots H_2 H_1}_{H} A = R$$

$$G_{n^2-1} \cdots G_1 A = \tilde{R}$$

$$Ax = b$$

$$H(Ax) = Rx = Hb$$

$$G(Ax) = \tilde{R}x = Gb$$