

Numerical Methods Übungen

Matrix Operations

Problem 1

Consider the following matrices. $[R_z]$ rotates a vector by an angle α about the z - axis, and $[R_x]$ rotates a vector by an angle β about the x - axis.

$$[R_z] = \begin{bmatrix} \cos(\alpha) & -\sin(\alpha) & 0 \\ \sin(\alpha) & \cos(\alpha) & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad [R_x] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\beta) & -\sin(\beta) \\ 0 & \sin(\beta) & \cos(\beta) \end{bmatrix} \quad (1)$$

- Determine $[R_z][R_x]$.
- Determine $[R_x][R_z]$.
- Is $[R_z]$ orthogonal for all α ? Is $[R_x]$ orthogonal for all β ?
- Determine $([R_z][R_x])^{-1}$.
- Determine the formulas for $\sin(2\alpha)$ and $\cos(2\alpha)$ by multiplying $[R_z]$ by itself.

Problem 2

Consider the following vector and matrix:

$$[\vec{v}] = \begin{bmatrix} e^{2i} \\ -\frac{2\sqrt{2}}{1+i} \\ \frac{1-i}{2} \end{bmatrix} \quad [a] = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix} \quad (2)$$

- Find $\|\vec{v}\|_1$ and $\|[a]\|_1$
- Find $\|\vec{v}\|_2$ and $\|[a]\|_2$
- Find $\|\vec{v}\|_\infty$ and $\|[a]\|_\infty$