Mechanical Engineering Dept.
Computer Aided Design M1363
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Assignment. (1)
Date:6/11/2023
Time:2 weeks

Instructions: The answers should include the aided MATLAB-scripts and the output results.

1. Show that if a matrix has two identical rows or two identical columns, the determinant of this matrix is equal to zero.
2. Show that if $\mathbf{a}$ and $\mathbf{b}$ are two parallel vectors, then $\mathbf{a} \times \mathbf{b} = 0$. Illustrate your answer by a number of examples.
3. Show that if $\mathbf{a}$ and $\mathbf{b}$ are two orthogonal vectors and $\mathbf{c} = \mathbf{a} \times \mathbf{b}$, then $|c| = |a||b|$.
4. Obtain the transformation matrix in terms of Euler angles in case of rotations about $x-$axis by $90°$. Sketch the original and transformed frames.
5. Find the transformation matrix $\mathbf{A}$ that results from a rotation $\theta = 20°$ of a vector $\bar{\mathbf{r}} = \begin{bmatrix} 0 & 2 & -6 \end{bmatrix}^T$ about another vector $\mathbf{r}$ $\mathbf{a} = \begin{bmatrix} -2 & 1 & 3 \end{bmatrix}^T$. Evaluate the transformed vector $\mathbf{r}$.
6. The vector $\bar{\mathbf{r}}$ has components defined in a rigid body coordinate system by the vector $\bar{\mathbf{r}} = \begin{bmatrix} 0 & 1 & 5 \end{bmatrix}^T$. The rigid body rotates with a constant angular velocity $\dot{\theta} = 20 rad/sec$ about an axis of rotation defined by the vector $\mathbf{v} = \begin{bmatrix} 1 & 0 & 3 \end{bmatrix}^T$. Determine the angular velocity vector and the transformation matrix at $t = 0.1 sec$.