

Advanced Mathematical techniques in Chemical Engineering

Module III : Vectors

Exercises

1. Consider the three vectors, $u_1 = [2 \ 1 \ 3]^T$, $u_2 = [4 \ 1 \ 5]^T$, and $u_3 = [2 \ 2 \ 4]^T$. Do these vectors form a basis set?
If not, select u_3 such that u_1 , u_2 and u_3 form a basis set. Find out the corresponding orthogonal and orthonormal basis set using u_1 , u_2 and newly selected u_3 .
2. Find the third vector such that with the vectors, $u_1 = [-3 \ 2 \ 1]^T$ and $u_2 = [2 \ -3 \ 0]^T$, it forms a basis set.
3. Check $u_1 = [1 \ 2 \ 3]^T$, $u_2 = [2 \ 3 \ 1]^T$ and $u_3 = [3 \ 1 \ 2]^T$ form a basis set or not. Using these basis vectors obtain a set or orthogonal and orthonormal basis set.
Consider the fourth vector $u_4 = [4 \ 1 \ -2]^T$ and express it in terms of the orthogonal-orthonormal basis vectors.
4. Find the third vector such that with the vectors, $u_1 = [1 \ 2 \ -1]^T$ and $u_2 = [2 \ -3 \ -2]^T$, it forms a basis set. Do these vectors form an orthogonal set? If not. construct an orthogonal, orthonormal basis set out of these three vectors.
5. Check whether the following vectors are linearly dependent or independent
 $u_1 = [1 \ 1 \ 1]^T$; $u_2 = [2 \ 3 \ 4]^T$; $u_3 = [4 \ 5 \ 6]^T$