Matrix Theory(EE5609) Assignment 1

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***Abstract*—This Assignment explains the concept of a vector parallel to resultant of two other vectors and finds a vector of given magnitude parallel to resultant vector**

Download all python codes from

https://github.com/anshum0302/EE5609/tree/master/codes

and latex-tikz codes from

https://github.com/anshum0302/EE5609

1 PROBLEM STATEMENT

Find a vector of magnitude 5 units, and parallel to the resultant of the vectors $\mathbf{a} = \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix}$,$\mathbf{b} = \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$.

2 Theory

Resultant $\mathbf{R}$ of two vectors $\mathbf{a}$ and $\mathbf{b}$ is the sum of two vectors.So $\mathbf{R} = \mathbf{a}+\mathbf{b} = \begin{pmatrix} a1 \\ a2 \\ a3 \end{pmatrix} + \begin{pmatrix} b1 \\ b2 \\ b3 \end{pmatrix} = \begin{pmatrix} a1+b1 \\ a2+b2 \\ a3+b3 \end{pmatrix}$.
If $\mathbf{R}$ is a vector of magnitude $\|\mathbf{R}\|$ then unit vector in the direction of $\mathbf{R}$ is $\frac{\mathbf{R}}{\|\mathbf{R}\|}$
And vector of magnitude λ parallel to $\mathbf{R}$ is $\frac{\lambda\mathbf{R}}{\|\mathbf{R}\|}$

3 Solution

First find resultant $\mathbf{R}$ of $\mathbf{a} = \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$

$\mathbf{R}=\mathbf{a}+\mathbf{b}=\begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix}+\begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix} = \begin{pmatrix} 2+1 \\ 3-2 \\ -1+1 \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}$.

Magnitude of $\mathbf{R}$ is $\|\mathbf{R}\| = \sqrt{3^2+1^2+0^2} = \sqrt{10}$.

Then unit vector $\mathbf{r}$ along $\mathbf{R}$ is $\frac{\mathbf{R}}{\|\mathbf{R}\|} = \frac{1}{\sqrt{10}}\begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}$

Then vector of magnitude 5 units parallel to resultant $\mathbf{R}$ is $5\mathbf{r} = \frac{5}{\sqrt{10}}\begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 3\sqrt{\frac{5}{2}} \\ \sqrt{\frac{5}{2}} \\ 0 \end{pmatrix} = \begin{pmatrix} 4.7434 \\ 1.5811 \\ 0 \end{pmatrix}$