edX

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5.1.1 Composing Rotations

5.1.1 Composing Rotations

Please note the following observation, posted on the discussion board:

```
    Hello,

it appears to me that at minute 3:40 of the video , matrix component a10 is indicated as
cos(rho)*sin(theta)+x*sin(rho)*cos(theta) while in my opinion should be
cos(rho)*sin(theta)+sin(rho)*cos(theta).

thanks Luca
```

▶   4:20 / 4:20   ▶ 1.0x   🔊   HD   ✖   CC   66

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Homework 5.1.1.1

3/3 points (graded)

For the following statements, find out if they are true or false.

- $$\begin{pmatrix} cos(\rho + \sigma + \tau) \\ sin(\rho + \sigma + \tau) \end{pmatrix} = \begin{pmatrix} cos(\tau) & -sin(\tau) \\ sin(\tau) & cos(\tau) \end{pmatrix} \begin{pmatrix} cos(\rho + \sigma) \\ sin(\rho + \sigma) \end{pmatrix}$$

[True ▾]   ✔ **Answer:** True

- $$\begin{pmatrix} cos(\rho + \sigma + \tau) \\ sin(\rho + \sigma + \tau) \end{pmatrix} = \begin{pmatrix} cos(\tau) & -sin(\tau) \\ sin(\tau) & cos(\tau) \end{pmatrix} \begin{pmatrix} cos(\rho)cos(\sigma) - sin(\rho)sin(\sigma) \\ sin(\rho)cos(\sigma) + cos(\rho)sin(\sigma) \end{pmatrix}$$

[True ▾]   ✔ **Answer:** True

- $$cos(\rho + \sigma + \tau) = cos(\tau)(cos(\rho)cos(\sigma) - sin(\rho)sin(\sigma)) - sin(\tau)(sin(\rho)cos(\sigma) + cos(\rho)sin(\sigma))$$
  $$sin(\rho + \sigma + \tau) = sin(\tau)(cos(\rho)cos(\sigma) - sin(\rho)sin(\sigma)) + cos(\tau)(sin(\rho)cos(\sigma) + cos(\rho)sin(\sigma))$$

[True ▾]   ✔ **Answer:** True

Explanation

Answer: True Extending the observations in the video, we know that

$$R_{\rho+\sigma+\tau}(e_0) = R_\tau(R_{\rho+\sigma}(e_0)).$$

But

$$R_{\rho+\sigma+\tau}(e_0) = \begin{pmatrix} \cos(\rho+\sigma+\tau) \\ \sin(\rho+\sigma+\tau) \end{pmatrix}$$

and

$$R_\tau(R_{\rho+\sigma}(e_0)) = \left(\begin{array}{c|c} \cos(\tau) & -\sin(\tau) \\ \hline \sin(\tau) & \cos(\tau) \end{array} \right) \begin{pmatrix} \cos(\rho+\sigma) \\ \sin(\rho+\sigma) \end{pmatrix}.$$

establishing the result.

- $$\begin{pmatrix} \cos(\rho+\sigma+\tau) \\ \sin(\rho+\sigma+\tau) \end{pmatrix} = \left(\begin{array}{c|c} \cos(\tau) & -\sin(\tau) \\ \hline \sin(\tau) & \cos(\tau) \end{array} \right) \begin{pmatrix} \cos\rho\cos\sigma - \sin\rho\sin\sigma \\ \sin\rho\cos\sigma + \cos\rho\sin\sigma. \end{pmatrix}$$

    True/False

Answer: True From the video we know that

$$R_{\rho+\sigma}(e_0) = \left(\begin{array}{c|c} \cos(\sigma) & -\sin(\sigma) \\ \hline \sin(\sigma) & \cos(\sigma) \end{array} \right) \left(\begin{array}{c|c} \cos(\rho) & -\sin(\rho) \\ \hline \sin(\rho) & \cos(\rho) \end{array} \right) \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} \cos\rho\cos\sigma - \sin\rho\sin\sigma \\ \sin\rho\cos\sigma + \cos\rho\sin\sigma. \end{pmatrix}$$

establishing the result.

- $$\begin{aligned} \cos(\rho+\sigma+\tau) &= \cos(\tau)(\cos\rho\cos\sigma - \sin\rho\sin\sigma) - \sin(\tau)(\sin\rho\cos\sigma + \cos\rho\sin\sigma) \\ \sin(\rho+\sigma+\tau) &= \sin(\tau)(\cos\rho\cos\sigma - \sin\rho\sin\sigma) + \cos(\tau)(\sin\rho\cos\sigma + \cos\rho\sin\sigma) \end{aligned}$$

    True/False

Answer: True This is a matter of multiplying the last result.

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ⓘ Answers are displayed within the problem