ELECENG 2FL3 ASSIGNMENT 2

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<u>Variation #37</u>

A1 = (0.4x, 0.9y, 0.7z), A2 = (0.7x, 0.2y, 0.4z), P = (6.4x, 10.0y, 2.8z)

Magnitude of a vector (denoted by ||) = sqrt(x^2 + y^2 + z^2)

<u>2.1</u>

a) dot product = A1x * A2x + A1y * A2y + A1z * A2z = 0.4 * 0.7 + 0.9 * 0.2 + 0.7 * 0.4 = 0.74

b) projection of A1 onto A2 = ((A1 dot A2) / ||A2||^2) * A2
= (0.74 / 0.8307^2) * A2 = 1.0723 * A2
= (0.7506x, 0.2145y, 0.4289z)

c) angle between A1 and A2 = arccos((A1 dot A2) / (||A1|| * ||A2||)) = 0.7418 rad

d) cross product = A1x * A2y + A1x * A2z + A1y * A2x + A1y * A2z + A1z * A2x + A1z * A2y
= 0.4x * 0.2y + 0.4x * 0.4z + 0.9y * 0.7x + 0.9y * 0.4z + 0.7z * 0.7x + 0.7z * 0.2y
= 0.08z - 0.16y - 0.63z + 0.36x + 0.49y - 0.14x
= (0.22x, 0.33y, -0.55z)

e) distance from origin to line defined by A1 at P = || A1O cross (A1P / ||A1P||) ||
A1O = P - A1 = (6x, 9.1y, 2.1z)
A1P = -A1 = (-0.4x, -0.9y, -0.7z)
d = || A1O cross (A1P / ||A1P||) || = 4.8581

f) distance from origin to plane defined by A1 and A2 at P = || A1O dot an ||
A1O = P - A1 = (6x, 9.1y, 2.1z)
an = (A1 cross A2) / || A1 cross A2 || = (0.3244x, 0.4867y, -0.8111z)
d = || A1O dot an || = 4.672

2.2

$$r = \sqrt[+]{x^2 + y^2}$$
$$\phi = \tan^{-1}(y/x)$$
$$z = z$$

P_{CCS} = (11.8727r, 1.0015rad Φ, 2.8z), $A1_{CCS}$ = (0.9849r, 1.1526rad Φ, 0.7z), $A2_{CCS}$ = (0.7280r, 0.2783rad Φ, 0.4z)

Dot product of $A1_{CCS}$ and $A2_{CCS}$ = A1r * A2r * cos(A1Φ - A2Φ) + A1z * A2z = 0.9849 * 0.7280 * cos(1.1526 - 0.2783) + 0.7 * 0.4 = 0.74
Yes it is the same as the dot product obtained in the RCS.

2.3

$$R = \sqrt[+]{x^2 + y^2 + z^2} \qquad x = R\sin\theta\cos\phi$$
$$\theta = \tan^{-1}[\sqrt[+]{x^2 + y^2}/z] \qquad y = R\sin\theta\sin\phi$$
$$\phi = \tan^{-1}(y/x) \qquad z = R\cos\theta$$

P_{SCS} = (12.1984r, 1.3392rad Θ, 1.0015rad Φ), $A1_{SCS}$ = (1.2083r, 0.9529rad Θ, 1.1526Φ), $A2_{SCS}$ = (0.8307r, 1.0684rad Θ, 0.2783rad Φ)

Cross product of $A1_{SCS}$ and $A2_{SCS}$ = A1r * A2Θ + A1r * A2Φ + A1Θ * A2r + A1Θ * A2Φ + A1Φ * A2r + A1Φ * A2Θ = (0.6781r, 2.5168rad Θ, 0.9828rad Φ)

Cross product in RCS = (0.22x, 0.33y, -0.55z)
Yes it is the same as the cross product obtained in the RCS.