CSCD18 A2 written part

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1 Information:

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We hereby affirm that all the solutions we provide, both in writing and in code, for this assignment are our own. We have properly cited and noted any reference material we used to arrive at this solution, and have not shared our work with anyone else.

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2 Part I: Tangent Equation

The curve is given by: $\bar{c}(t) = (x(t), y(t), z(t))^T$, and we have

$$x(t) = (R+r)cos(t) - r \cdot cos(\frac{R+r}{r} \cdot t)$$

$$y(t) = (R+r)sin(t) - r \cdot sin(\frac{R+r}{r} \cdot t)$$

$$z(t) = r \cdot cos(\frac{R}{r} \cdot t)$$

Then the tangent $\vec{\alpha}$ for this 3D curve will be:

$$\frac{d\bar{c}(t)}{dt} = (\frac{dx(t)}{dt}, \frac{dy(t)}{dt}, \frac{dz(t)}{dt})$$

$$\Rightarrow \frac{dx(t)}{dt} = -(R+r)sin(t) + r \cdot \frac{R+r}{r} \cdot sin(\frac{R+r}{r} \cdot t)$$

$$\Rightarrow (R+r)(sin(\frac{R+r}{r} \cdot t) - sin(t))$$

$$\Rightarrow \frac{dy(t)}{dt} = (R+r)cos(t) - r \cdot \frac{R+r}{r} \cdot cos(\frac{R+r}{r} \cdot t)$$

$$\Rightarrow (R+r)(cos(t) - cos(\frac{R+r}{r} \cdot t))$$

$$\frac{dz(t)}{dt} = r \cdot \frac{R}{r} \cdot -sin(\frac{R}{r} \cdot t)$$

$$\Rightarrow -R \cdot sin(\frac{R}{r} \cdot t)$$

So the tangent $\vec{\alpha}$ is:

$$((R+r)(sin(\frac{R+r}{r} \cdot t) - sin(t)), (R+r)(cos(t) - cos(\frac{R+r}{r} \cdot t)), -R \cdot sin(\frac{R}{r} \cdot t))$$