

Aufgabe 2

Gesucht sind  $\dot{r} = \frac{dr}{dt}$  und  $\ddot{r} = \frac{d^2r}{dt^2}$  für  $r(t)$

$$\Rightarrow \frac{df}{dx} = 2x\mathbf{i} + 3\mathbf{j} + \cos x \mathbf{k}$$

$$\Rightarrow \frac{d^2f}{dx^2} = 2\mathbf{i} - \sin x \mathbf{k}$$

$$\Rightarrow \left| \frac{df}{dx} \right|_{dx=1} = 2(1)\mathbf{i} + 3\mathbf{j} + \cos(1)\mathbf{k} = 2\mathbf{i} + 3\mathbf{j} + \mathbf{k} = \sqrt{2^2 + 3^2 + 1^2} = \sqrt{9 + 1} = \sqrt{10}$$

$$\Rightarrow \frac{d}{dx}(F \cdot f) = F \frac{df}{dx} + f \frac{dF}{dx}$$

$$= (x^2\mathbf{i} + (3x+2)\mathbf{j} + \sin x \mathbf{k}) \cdot (2x\mathbf{i} + 3\mathbf{j} + \cos x \mathbf{k}) + (x^2\mathbf{i} + (3x+2)\mathbf{j} + \sin x \mathbf{k}) \cdot (2x\mathbf{i} + 3\mathbf{j} + \mathbf{k}) \\ = 2x^3 + (9x+6)\mathbf{j} + (\cos x \sin x) + 2x^3 + (9x+6) + (\cos x \sin x) \\ = 4x^3 + 18x + 12 + 2 \cos x \sin x$$

$$IF \quad r = (t^2 + 3t)\mathbf{i} - 2 \sin 3t \mathbf{j} + 3e^{2t} \mathbf{k} \text{ determine}$$

$$\Rightarrow \frac{dr}{dt} = (2t+3)\mathbf{i} - 6 \cos 3t \mathbf{j} + 6e^{2t} \mathbf{k}$$

$$\Rightarrow \frac{d^2r}{dt^2} = 2\mathbf{i} + 18 \sin 3t \mathbf{j} + 12e^{2t} \mathbf{k}$$

$$\Rightarrow \text{The value of } \left| \frac{d^2r}{dt^2} \right| \text{ at } t=0$$

$$= 2\mathbf{i} + 18 \sin 3(0)\mathbf{j} + 12e^{2(0)} \mathbf{k} = 2\mathbf{i} + 0\mathbf{j} + 12\mathbf{k} = 2\mathbf{i} + 12\mathbf{k} = \sqrt{2^2 + 12^2} = \sqrt{4 + 144} = \sqrt{148}$$