

$$v = \sqrt{\dot{x}^2 + \dot{y}^2 + \dot{z}^2} = \sqrt{(-bk \cdot \sin(kt))^2 + (bk \cdot \cos(kt))^2 + (2bk^2 t)^2}$$

$$v = \sqrt{b^2 k^2 \sin^2(kt) + b^2 k^2 \cos^2(kt) + 4b^2 k^4 t^2} = \sqrt{b^2 k^2 (\sin^2(kt) + \cos^2(kt)) + 4b^2 k^4 t^2}$$

$$v = \sqrt{b^2 k^2 (1 + 4k^2 t^2)} = bk \sqrt{1 + 4k^2 t^2}$$

$$a_t = \frac{dv}{dt} = bk \cdot \frac{8k^2 t}{2\sqrt{1+4k^2 t^2}} = \frac{4bk^3 t}{\sqrt{1+4k^2 t^2}}$$

$$a_n = \sqrt{a^2 - a_t^2} = \sqrt{a_x^2 + a_y^2 + a_z^2 - a_t^2} = \sqrt{b^2 k^4 \sin^2(kt) + b^2 k^4 \cos^2(kt) + 4b^2 k^4 - \frac{16b^2 k^6 t^2}{1+4k^2 t^2}}$$

$$a_n = \sqrt{\frac{5b^2 k^4 + 20b^2 k^6 t^2 - 16b^2 k^6 t^2}{1+4k^2 t^2}} = \sqrt{b^2 k^4 \frac{5+4k^2 t^2}{1+4k^2 t^2}} = bk^2 \sqrt{\frac{5+4k^2 t^2}{1+4k^2 t^2}}$$