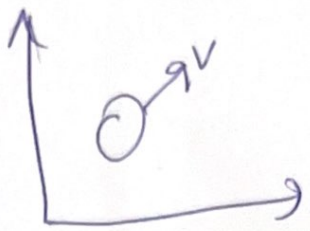
$$F = -\frac{1}{2}\pi R^2 \rho C v^2$$




$m\ddot{x}$

$$v = \sqrt{\dot{x}^2 + \dot{y}^2}$$

$$\cos\theta = \frac{\dot{x}}{\sqrt{\dot{x}+\dot{y}}}$$

$$m\ddot{x} = -\frac{\pi R^2 \rho C}{2}(\dot{x}^2 + \dot{y}^2)$$

$$v_x = v\cos\theta$$

$$= \dot{x}$$

$$m\ddot{y} = -mg - \frac{\pi R^2 \rho C}{2}(\dot{x}^2 + \dot{y}^2)$$

$$v_y = \dot{y}$$

$$\vec{a} = \ddot{x}\hat{x} + \ddot{y}\hat{y}$$

$$\hat{v} = \frac{v_x}{v}\hat{x} + \frac{v_y}{v}\hat{y}$$

$$\vec{v} = v_x\hat{x} + v_y\hat{y}$$

$$\vec{F} = m\ddot{\vec{x}} = -mg\hat{y} + F\hat{v}$$

$$= -mg\hat{y} - \frac{1}{2}\pi R^2 \rho C v^2 \frac{v_x}{v}\hat{x} - \frac{1}{2}\pi R^2 \rho C v^2 \frac{v_y}{v}\hat{y}$$

$$\ddot{\vec{x}} = -g\hat{y} - \frac{1}{2}\pi R^2 \rho C v^2 \frac{v_x}{mv}\hat{x} - \frac{1}{2}\pi R^2 \rho C v^2 \frac{v_y}{mv}\hat{y}$$

$$\ddot{x} = -\frac{1}{2}\pi R^2 \rho C v^2 \frac{v_x}{mv}$$

$$\ddot{x} = -\frac{1}{2}\pi R^2 \rho C v^2 \frac{v_x}{mv} = -\frac{1}{2m}\pi R^2 \rho C \sqrt{\dot{x}^2 + \dot{y}^2}\,\dot{x}$$

$$\ddot{y} = -g - \frac{1}{2m}\pi R^2 \rho C \dot{x}\sqrt{\dot{x}^2 + \dot{y}^2}$$