epsilon:

$$z = a * \sin(2\pi f t)$$
$$\dot{z} = 2\pi f a * \cos(2\pi f t)$$
$$\ddot{z} = -4\pi^2 f^2 a * \sin(2\pi f t) = -4\pi^2 f^2 z$$
$$a_y = -\ddot{z} = 4\pi^2 f^2 z$$
$$a_x = \alpha$$
$$\vec{a} = [\alpha, 4\pi^2 f^2 z]$$
$$\epsilon_1 = \left. \frac{\vec{l}}{2} * m * \vec{a} \middle/ \frac{1}{3} m l^2 \right. = \frac{3}{2l} a \cdot (-\cos\phi, \sin\phi)$$
$$\epsilon_2 = \left. \frac{l}{2} * \frac{l}{2} * \omega * \mu \middle/ \frac{1}{3} m l^2 \right. = \frac{3}{4m} \omega\mu$$
$$\epsilon = \epsilon_1 - \epsilon_2 = \frac{3}{2l} a \cdot (-\cos\phi, \sin\phi) - \frac{3}{4m}\omega\mu$$

simulate:

$$i(0) = 0$$
$$t(0) = 0$$
$$\phi(0) = \phi_0$$
$$x(0) = x_0$$
$$\omega(0) = \omega_0$$
$$v(0) = v_0$$
$$z(0) = 0$$

$$i[i+1] = i[i] + 1$$
$$t[i+1] = t[i] + \frac{1}{f_{prob}}$$
$$z[i+1] = a * \sin\big(2\pi f(t+1)\big)$$
$$\alpha[i+1] = \alpha(\phi[i], \omega[i], z[i])$$
$$\epsilon[i+1] = \epsilon(\phi[i], \omega[i], \alpha[i], z[i])$$
$$\omega[i+1] = \omega[i] + \frac{\epsilon[i] + \epsilon[i+1]}{2} * \frac{1}{f_{prob}}$$
$$v[i+1] = v[i] + \frac{\alpha[i] + \alpha[i+1]}{2} * \frac{1}{f_{prob}}$$
$$\phi[i+1] = \phi[i] + \frac{\omega[i] + \omega[i+1]}{2} * \frac{1}{f_{prob}}$$
$$x[i+1] = x[i] + \frac{v[i] + v[i+1]}{2} * \frac{1}{f_{prob}}$$