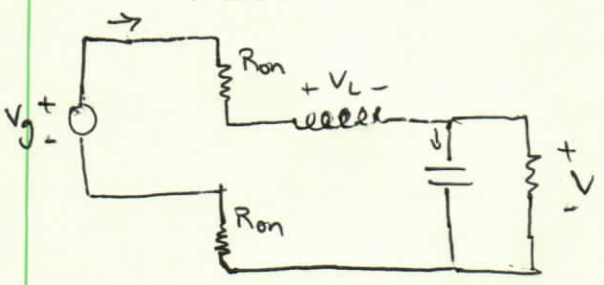
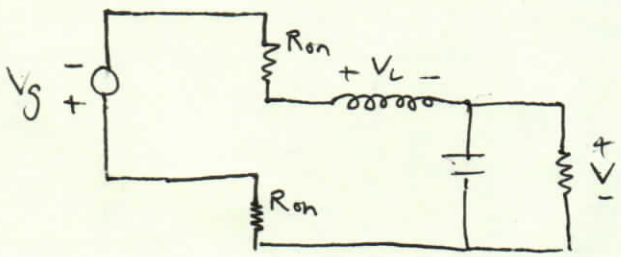
1. a)

Mode 1



Mode 2



$$x(t) = \begin{bmatrix} \bar{f}_1(x(t), u(t)) \\ f_2(x(t), u(t)) \end{bmatrix} = \begin{bmatrix} \frac{d}{dt}\langle i(t)\rangle_{T_s} \\ \frac{d}{dt}\langle v(t)\rangle_{T_s} \end{bmatrix}$$

$$x(t) = \begin{bmatrix} \frac{1}{L}\left[\langle v_g(t)\rangle_{T_s} - \langle v(t)\rangle_{T_s} - 2R_{on}\langle i(t)\rangle_{T_s}\right] d(t) \\ \qquad + \frac{1}{L}\left[-\langle v_g(t)\rangle_{T_s} - \langle v(t)\rangle_{T_s} - 2R_{on}\langle i(t)\rangle_{T_s}\right] d'(t) \\ \frac{1}{C}\left[\langle i(t)\rangle_{T_s} - \frac{\langle v(t)\rangle_{T_s}}{R}\right] d(t) + \frac{1}{C}\left[\langle i(t)\rangle_{T_s} - \frac{\langle v(t)\rangle_{T_s}}{R}\right] d'(t) \end{bmatrix}$$