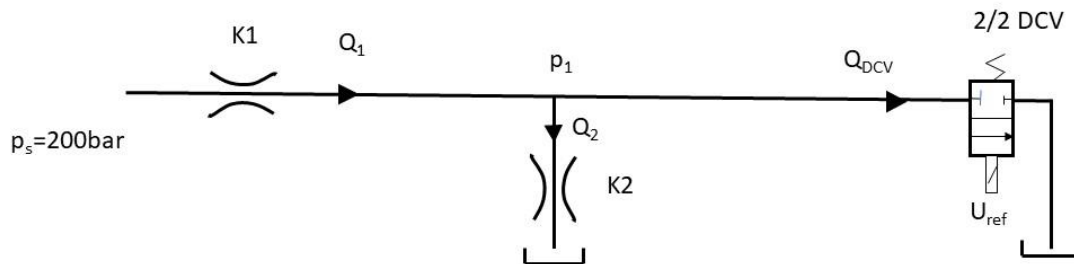Derive the dynamic model and simulate the dynamics of the following circuit. The following parameters and assumptions are used

The throttle valves K1 and K2 have fixed sharp-edged orifices with circular cross-section

The diameters are d_1=3mm and d_2=2 mm, discharge coefficient C_d=0.6 and oil density =860kg/m^3

The total volume between the three components is V = 2 litres

The effective bulk modulus of that volume including all flexibilities is B_e=1300 MPa

The 2/2 directional valve passes through 100l/min with pressure drop 30bar and full input voltage 10V. The -45° phase shift of the valve is 5 Hz. The valve has a linear cross section area with respect to the input voltage after the positive overlap, which is 20% of the full input.

The system is supplied by an ideal pressure source with p_s=200bar pressure and the tank pressure is assumed to be 0.

Calculate the response of pressure p_1, when the valve has a step input 4V to 8V. Simulation time is 10s and step time 2s, Use integrator ODE4, Runge-Kutta with a step size 1e-4 s.