Homework 6.F

Given: A block of mass m is attached to a grounded spring (of stiffness k) and two dashpots (having damping coefficients c and $2c$), as shown in the figure. Let x represent the motion of the block, with $x = 0$ when the spring is unstretched.

Find: For this problem:
(a) Derive the dynamical equation of motion (EOM) of the system in terms of the coordinate x;
(b) Determine the static equilibrium position of the block, x_{st};
(c) Rewrite the EOM of the system in terms of the variable $z = x - x_{st}$, where z represents the position of the block relative to its static equilibrium position; and,
(d) Determine undamped natural frequency ω_n, the damping ratio ζ and the damped natural frequency ω_d for the system in terms of, at most, the parameters of the problem: m, c and k.