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Session 2: MDOF systems

Consider the following three degrees-of-freedom model:

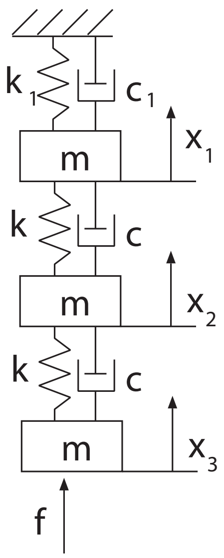

Figure 1: 3-DOFs system

- Write the equations of motion in the time domain in a matrix form.
- For the numerical values $m = 1\,kg$, $k = k_1 = 16\,N/m$, $c = c_1 = 0.1\,Ns/m$, compute the eigenfrequencies and the mode shapes of the conservative system. Represent the mode shapes, and check the orthogonality conditions. .
- For the value of $k_1 = k$, compute the impulse response for x_3 by projecting the equations of motion in the modal basis. Represent the Bode diagram for the same coordinate x_3/f, and for the acceleration $\ddot{x}_3/f$. Is the modal damping hypothesis valid ? Multiply by a factor 5 the damping coefficient of mode 2 and plot the Bode diagram for x_3 on the same graph as with the initial value of the damping. Comment.
- Consider the case when c_1=0. Is the modal damping hypothesis still verified ? Draw the Bode diagram for x_3/f using the full system of equations (solve frequency by frequency). Compare with the modal approach in which the coupling is neglected. Comment

Note: Use the `eig` function to compute the eigenfrequencies and mode shapes.