Department of Mechanical, Materials & Manufacturing Engineering

DYNAMICS (VIBRATION)

SHEET 7 : VIBRATION ISOLATION

1. Derive the displacement transmissibility for the system in Figure Q1.

$$T_D = \sqrt{\frac{k^2 + \omega^2 c^2}{\left(k + K - m\omega^2\right)^2 + \omega^2 c^2}}$$

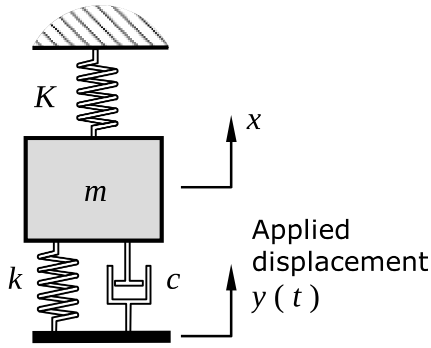
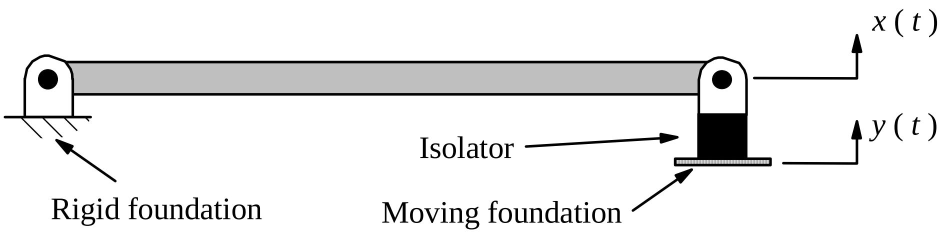


Figure Q1

2. A rigid, uniform, horizontal bar (mass 15 kg, length 1 m) is simply supported at each end. As shown below, one support is connected to a rigid foundation, but the other end is subjected to a vertical sinusoidal displacement at 50 Hz. Find the isolation efficiency (i.e., the percentage reduction in the displacement amplitude of the bar) obtained by introducing an isolator (stiffness 180 kN/m, damping coefficient 75 Ns/m) between this support and its moving foundation.



42.3 %

3. A compressor of mass 300 kg is to be installed on 4 isolators, two at each end. The centre of mass is 0.4 m from end A and 0.2 m from end B. In the end elevation, the isolators are located symmetrically with respect to the centre of mass.

   Isolators are available with stiffnesses of 40, 70, 110, 180 and 290 kN/m and each has a maximum allowable static deflection of 10 mm. Select suitable isolators for the installation so that the isolation efficiency is at least 70% at the normal running speed of 870 rev/min. Estimate the actual isolation efficiency for each of the isolators you select. You should neglect damping.

   2 off 70 kN/m at A, 2 off 180 kN/m at B (110 kN/m also satisfactory, but static deflection is close to maximum);
   80% at A, 72% at B.