University of Nottingham

School of Mechanical, Materials and Manufacturing Engineering - Dynamics (MM2DYN)

VIBRATION: EXERCISE SHEET 7 – VIBRATION ISOLATION - PART I

1. Derive the force transmissibility of the vibration isolation system shown in Figure 1, considering the vertical displacement of machine, $x(t)$. An applied vertical force, $p(t)$, is applied to the mass. For this system:
   (a) Estimate the worst isolation efficiency when the machine is operating at a minimum frequency ratio (ω/ω_n) of 5. Hints: For estimating the transmissibility when the operating frequency is much larger than the natural frequency of system, zero damping can be assumed.
   (b) The machine is then replaced by a new machine that weighs only half of the previous weight. The same isolation system is used. At a given excitation frequency, would the isolation efficiency for this new system be lower or higher than that of previous system?
   (c) An additional spring system is to be added to the current one. Determine the suitable spring stiffness for this new spring, so that the characteristics of isolation efficiency will be similar to the original one.

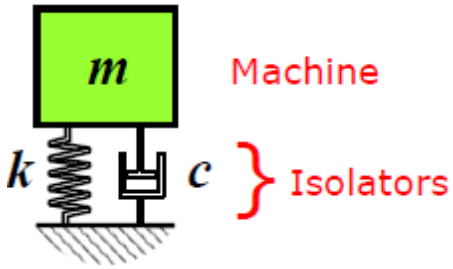

Figure 1. A vibration isolation system.

2. Figure 2 shows a mass-spring-damper system, with force $p(t)$ applied to the mass.
   (a) Derive the equation of motion for this system.
   (b) Determine the expression for the force transmissibility with respect to the fixed ground A. Hints: Consider the force transmitted to ground *A*.
   (c) Determine the expression for the force transmissibility with respect to the fixed ground B. Hints: Consider the force transmitted to ground *B*.

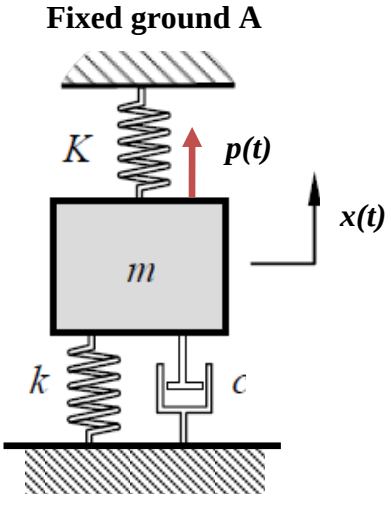

Figure 2.