

1st Homework Assignment
 Due Saturday: 1/1/1425 H

A reciprocating engine is mounted on a foundation as shown in Fig. 1. The unbalanced forces and moments developed in the engine are transmitted to the frame and the foundation. An elastic pad is placed between the engine and the foundation block to reduce the transmission of vibration. Develop two mathematical models of the system using a gradual refinement of the modeling process.

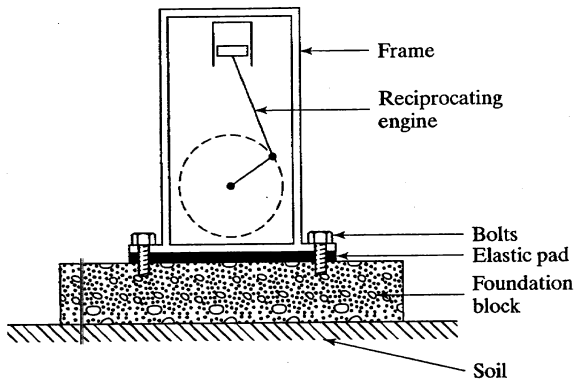


Figure. 1 A reciprocating engine on a foundation.

Determine the equivalent spring constant of the system shown in Fig. 2 .

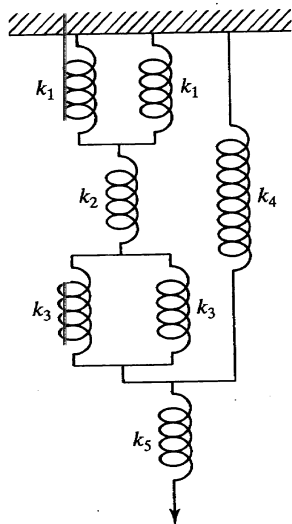


FIGURE. 2 Springs in series—parallel.

Figure. 3 shows a human body and a restraint system at the time of an automobile collision. Suggest a simple mathematical model by considering the elasticity, mass, and damping of the seat, human body, and the restraints for a vibration analysis of the system.

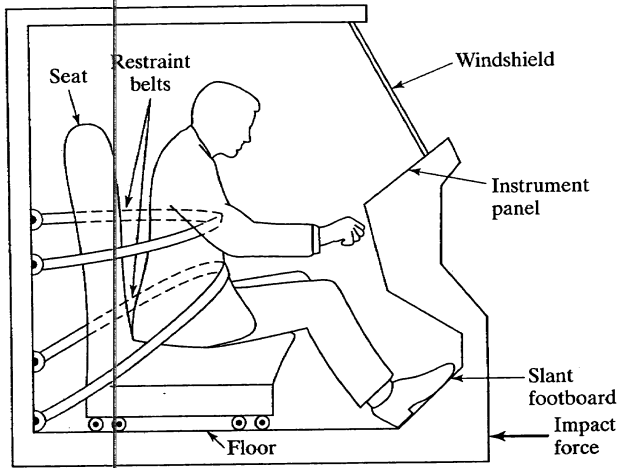


FIGURE. 3 A human body and a restraint system.

An automobile moving over a rough road (Fig. 4) can be modeled considering (a) weight of the car body, passengers, seats, front wheels, and rear wheels; (b) elasticity of tires (suspension), main springs, and seats; and (c) damping of the seats, shock absorbers, and tires. Develop three mathematical models of the system using a gradual refinement in the modeling process.

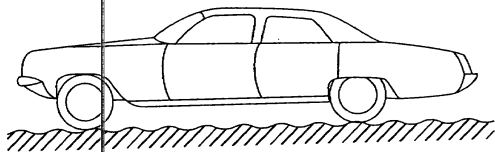


FIGURE. 4 An automobile moving on a rough road.