

In Mechanical Vibrations, the mass-spring-damper system is one of the most important systems in the topic. The system can be used to determine the equation of motion which is derived from Newton's second law.

$$\sum F = ma$$

Where:

m is a mass of a point mass

F is the resultant of all forces.

A is the absolute acceleration.

From the Figure, the system consists of a damper with a damping coefficient 'K' and a spring with a spring constant of 'd' which are attached to the wall and a mass and an external force 'F'.

The force from the spring can be expressed as

$$F_s = kx$$

The force from the damper can be expressed as

$$F_d = d \dot{x}$$

Then, the resultant force can be determined from

$$\sum F_x = m\ddot{x} = -F_s - F_d + F$$

Finally, the equation of motion is equal to

$$F = m\ddot{x} + d\dot{x} + kx$$