

Basics of Mechanical Vibrations

In the field of dynamics, there are many kinds of motion profiles that occur under the action of forces and moments, which generate accelerations and velocities. Among the various motion profiles, the repetitive elastic motion is of particular interest as it can cause fatigue in such components and impact their integrity and reliability in the long run. Such repetitive motion is commonly termed vibration and as it is present in almost all types of mechanical systems, commonly described as mechanical vibrations.

Mechanical vibrations are primarily a result of exchange of energy between the inertia of the body and the elastic effects present in the system. In addition, as most systems possess some kind of dissipative mechanism e.g. friction, viscosity etc., the mechanical vibrations also involve dissipative forces. It is worth noting here that in general, as the elastic motion of bodies is fairly complex to model and solve, we can employ useful simplifications e.g. spring-mass-damper models and mode superposition, as the amplitudes of mechanical vibrations are generally small.

The present short course is intended as an introductory material with regard to the field of mechanical vibrations and discusses the spring-mass-damper system, as the fundamental building-block for modelling the vibrations in complex systems. The course also presents the basic ideas of isolation / absorption, along with multi degrees-of-freedom systems that bring in the concept of mode shapes and modal superposition. The participants can expect to acquire basic knowledge about setting up different types of vibrational problems in the context of mechanical systems. The course is of twelve hours duration and is delivered over six weeks.