# Natural Frequency

The natural frequency is the frequency of the oscillations when the system is not disturbed. Thus, the load should be taken as zero, while the system is oscillating with a frequency. Then any frequency that solves the governing equation are the natural frequencies of the system.

Equation 1 is the governing equation of the system. It is assumed to be separatable. Hence, Equation 3 can be written. Equations 1, 2, and 3 can be combined to create Equation 4.

How Equation 4 leads to Equation 5?

The axial force in the spring can be seen in Equation 7. Using Equations 3, 5, and 6 it can also be simplified to Equation 8.

Using the axial force, the force balance on the mass can be written as in Equation 9.

As it was said before, for the natural frequency analysis, the load must be zero, which leads to Equation 10 where the acceleration of the mass is written in terms of the spring position.