

# A Note on the Influence of Intermediate Restraints and Hinges in Frequencies and Mode Shapes of Beams

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## Abstract:

This note deals with the free transverse vibration of a beam with two arbitrarily located internal hinges, four intermediate elastic restraints, and ends elastically restrained against rotation and translation. The method of separation of variables is used for the determination of the exact frequencies and mode shapes. New results are presented for different boundary conditions and restraint conditions in the internal hinges. The mathematical model is also used to study the influence on the frequencies and mode shapes of varying intermediate supports that are located at the nodal points of higher modes. A detailed numerical study on the effects of the locations of intermediate translational restraints and their stiffness on the natural frequencies and mode shapes is performed for different boundary conditions. The effect of the presence of the internal hinges is also analysed. Graphs and tables of the non-dimensional frequencies and the corresponding mode shapes are given in order to illustrate the behaviour of frequency parameters and the presence of mode shape switching.