

The fixed-points theory revisited with new applications

Abstract

The fixed-points theory has its root dating back to 1932. Hahnkamm suggested that there are two fixed points in the undamped primary structure's frequency response function (FRF) for the two-degree-of-freedom system when a harmonic force is applied to the primary mass. These points are independent of the damping value in the auxiliary system, which is the control system, and their heights are mainly determined by the mass ratio of the device. The desired optimum value of the tuning ratio is obtained when the heights of the fixed points are equal. Fourteen years later, Brock suggested that the optimum value of the damping ratio in the control device can be determined by making the height of the fixed points the maximum. Since then, the fixed-points theory has been used in many applications as one of the design laws in fabricating a vibration neutralizer. In this article, the theory is reformulated by using the conventional definition of the damping ratio. It is proved that the same result can be obtained as in the original derivation. The application of the theory is then extended to the control of global vibration of an undamped continuous structure and is demonstrated on a simply supported beam.