Abstract

This study is concerned with the piecewise linear (PWL) dynamics of a cracked Rayleigh beam. The change in stiffness at the crack location due to mode I crack in the beam is implemented by using a PWL spring at the crack location resulting in slope discontinuity during the crack opening. On crack closure, the frictional contact between the surfaces leads to forces that exhibit hysteresis and an empirical hysteretic damping model is incorporated in PWL form. A semi-analytical approach is evolved and we present some of the interesting results emerging in the free and forced dynamics of such systems. An interesting method based on the canonical Action-Angle variables and the method of averaging is devised to study the forced PWL oscillator by deriving a slow-flow model. Experimental modal analysis has been performed on cracked beams to estimate the modal frequencies.