Random vibration of beams resting on fractional dampers and non-linear supports

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Abstract

A frequency domain statistical linearization approach is proposed to estimate response statistics of randomly excited beams resting on linear concentrated fractional dampers and non-linear supports. Specifically, the non-linear beam is replaced by an equivalent linear one, whose frequency response function is derived in an exact closed form. The proposed approach applies for any number of fractional dampers and non-linear supports along the beam span and exhibits different advantages as compared to the conventional statistical linearization based on a normal modes expansion. The reliability and accuracy of the proposed method is checked against Monte Carlo simulations, carried out using a pertinent boundary integral method in conjunction with a Grünwald-Letnikov algorithm for the calculation of the fractional derivative and a Newmark integration scheme.