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Theoretical Study on the Forced Vibration of One Degree of Freedom System, Equipped with Inerter, under Load-Type or Displacement-Type Excitation

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Abstract : In this paper, a theoretical study on the forced vibration of one degree of freedom system equipped with inerter, working under load-type or displacement-type excitation, is presented. Differential equations of movement are solved under cosinusoidal excitation, and explicit relations for the magnitude, resonant magnitude, phase angle, resonant frequency, and critical frequency are obtained. Influence of the inertance and damping on these dynamic characteristics is clarified. From the obtained results, one concludes that the inerter increases the magnitude of vibration and the phase angle of the damped mechanical system. Moreover, the magnitude ratio and difference of phase angles are not depending on the actual type of excitation. Consequently, such kind of similitude allows for the comparison of various theoretical and experimental results, which can be broadly found in the literature.

Keywords : displacement-type excitation, inerter, load-type excitation, one degree of freedom vibration, parallel connection
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