Frequency detuning effects for parametrically and directly excited elastic structures - DTU Orbit (11/12/2018)

**Frequency detuning effects for parametrically and directly excited elastic structures**
This study investigates the frequency detuning effects of parametric and direct excitation for near-resonant nonlinear structural vibrations. Specifically, the detuning effects of a two-to-one frequency ratio between the parametric and direct excitation, and of a drift in natural frequency, are studied. These effects are investigated theoretically using a Duffing-Mathieu equation as the model system, and experimentally using a cantilever beam as the model object. The approximate analytical responses are derived using the method of varying amplitudes, and compared with results of direct numerical integration and experiments showing good agreement. For frequency detuned superthreshold parametric excitation some of the theoretical frequency-amplitude solution branches appear to merge. For some ranges of parametric excitation frequency a drop in experimental steady-state vibration amplitude was found, indicating performance degradation whereas for other frequency ranges, frequency detuning may yield an increased steady-state vibration amplitude. This makes frequency detuning a feature which can purposefully be avoided or utilized, dependent on the application.

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