Parameter identification of nonlinear dynamical systems with the combined use of Hilbert Huang Transform and Multiple Scale Method

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The inverse problem, i.e. the identification of the parameters of mechanical systems once the dynamical response is known, e.g., from experimental recordings, is of wide technical interest. Particularly challenging is the identification of nonlinear systems, aimed at capturing the magnitude of the nonlinearity which can strongly affect the system behavior.
This work is inspired by [1], where dynamic identification of a two d.o.f. nonlinear mechanical model is carried out, combining the use of the Hilbert Huang Transform (HHT) [2] with the Complexification Averaging (CxA) analytical method. Here the same problem has been tackled, however combining the HHT with the Multiple Scales Method (MSM) [3] instead of CxA. Indeed, it is shown how the Amplitude Modulation Equations, obtained imposing solvability of the perturbation equations, can be used to give information consistent with the output of the HHT, giving rise to the possibility of identification of the system parameters from experimental registrations. Furthermore, the aim here is also to extend the procedure to continuous nonlinear systems like beams, in presence of either geometrical or mechanical nonlinearities, exploiting the direct approach [4].

References

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