Abstracts

A Study of a Driven Oscillator with FM Feedback by Use of a Phase-Lock-Loop Model

The locking phenomenon of a driven oscillator has been studied by many authors. Huntoon and Weiss have characterized it by their locking signatures. It is also known that the difference phase of an oscillator and that of a phase-locked-loop (PLL) obey the same differential equation. In this paper a PLL configuration is obtained which yields the same locking signatures as those for the oscillator. Thus the equivalence between the oscillator and the PLL model is established both in terms of locking signature as well as in terms of frequency behavior. Since the nonlinear equations describing the oscillator and PLL model are identical, any static or dynamic results which apply to one also apply to the other. In systems containing oscillators, each oscillator maybe replaced by its equivalent PLL model so that the system may be analyzed more easily. For example, the locking-signature shape and the locking bandwidth of two coupled oscillators are given in terms of parameters which are easy to measure. In a second example, results are presented which describe the performance of an oscillator which is frequency modulated by a feedback signal. It is found that the signature shape and locking bandwidth may be set to any desired value by the proper choice of feedback parameters. Experimental results are presented which verify the theoretical results.

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