Abstracts

Analysis of Varactor Frequency Multipliers: Nonlinear Behavior and Hysteresis Phenomena

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A nonlinear analysis of varactor frequency multipliers has been performed and numerically implemented to obtain the quantities that must be specified to define the quality of a multiplier used to generate high spectral purity signals for metrological purposes. The theoretical model has proved adequate to predict the existence of complicated hysteresis phenomena, confirmed by experimental investigation. The practical cases examined refer to abrupt-junction doublers and triplers operating in self-bias conditions. The circuit parameters have been determined for maximum efficiency at a given generator available power. Then, some effects of input power, frequency, and tuning variations have been investigated, and calculated curves including hysteresis cycles are shown. Beside the optimization of the multiplier operation, the equations given are sufficiently general to yield the information requested on multipliers of this kind, where the power handling capabilities of the varactor are not fully exploited but the high spectral purity of the input signals must be preserved. As an example, one of the most important features of the frequency multiplier, i.e., the AM-PM conversion, was determined in a practical case for varying input power levels.

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