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**Analysis of Nonlinear Sustained Oscillations in Discrete Systems with Backlash and Resolution
by Using a Discretization-Oriented Describing Function**

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Abstract: In this paper, a discretization-oriented describing function is derived for nonlinear devices combining backlash and quantization (resolution) while being subject to discretization through a sampler and zero-order hold. Such a describing function is frequency-dependent so that the overall nonlinearity, which includes both resolution and backlash, is interpreted as possessing nonlinear inertia. That nonlinear inertia is generated by the sampling process, since it does not appear if the system is continuous. The presence of nonlinear sustained oscillations (limit cycles) is investigated through simulations.

Key Words: Backlash, describing function, resolution

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