Fluctuations of Single-Mode Laser Driven by Two Different Kinds of Colored Noise

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Abstract: A single-mode laser with coupling between additive and multiplicative noise terms is investigated when the multiplicative noise and the coupling between two noise terms are colored fluctuations with finite correlation times τ_1 and τ_2. Combining the unified colored noise approximation (UCNA) and the functional analysis, the stationary probability distribution (SPD) and the variance of the laser intensity is derived. It is found that the colored nature of multiplicative noise and the coupling strength between two noise terms can affect both the structure and the height of the SPD, while the colored nature of the coupling between two noise terms can only affect the height of the SPD. The multiplicative noise can enhance the intensity fluctuations while the additive noise can reduce the fluctuations in a laser system. Numerical simulations are presented and consistent to the analytical results.

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