Time-delayed feedback control of coherence resonance

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We study the constructive influence of noise upon a nonlinear dynamic system and its control by time-delayed feedback methods. Two different types of coherence resonance of noise-induced oscillations are found in systems close to, but below, a sub- or supercritical Hopf bifurcation, respectively. They are explained by a mean-field approximation of the Hopf normal forms, elucidating the different effect of noise upon the power spectrum near sub- and supercritical bifurcations. It is shown analytically and numerically that time-delayed feedback as proposed by Pyragas for deterministic chaos control [1] can be used for effective manipulation of the coherence and the timescales of noise-induced oscillations and patterns [2]. Our analytical results elucidate how the correlation time and the spectral properties of the noise-induced oscillations can be optimized as a function of delay and feedback strength [3, 4]. Further, we investigate the control of noise-induced space-time patterns in a globally coupled nonlinear reaction-diffusion model [5].

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