Ultraflat Soliton Microcombs in Driven Microresonators with Quadratic and Kerr Nonlinearity

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Abstract:

We report the generation of broadband ultraflat soliton microcombs via a phase-matched second-harmonic generation process in a driven quadratic-Kerr microring resonator when operating at anomalous dispersion for the fundamental-frequency field and weak normal dispersion for the second-harmonic component. Compared with the platicon microcombs that operate in both the normal dispersion regimes for the interacting two fields, these combs exhibit nearly 0-dB comb-line power variations over a broad spectral range. We ascribe the enhanced flatness of soliton microcombs to the combined action of cavity loss and dispersive wave generation, the latter of which can be well predicted by our analytical criteria. Our results offer pathway to realize octave-spanning, highly efficient, coherent ultraflat combs without needing external phase or intensity modulators, enabling applications such as high-capacity telecommunications, precision metrology, dual-comb spectroscopy, spectrograph calibration, and parallel ranging.

Keywords:

Ultraflat Soliton Microcombs, dispersive wave, second-harmonic, cavity loss.