* Electronic Address: puzyrev@math.tu-berlin.de
[1] Berlin Institute of Technology
[2] Weierstrass Institute of Berlin
[3] Institute for Theoretical Physics, University of Münster

Modulational instability and zigzagging of dissipative solitons induced by delayed feedback

Dmitry Puzyrev[1*], Andrei Vladimirov[2], Svetlana Gurevich[3], Serhiy Yanchuk[1]

We report a destabilization mechanism of localized solutions in spatially extended systems which is induced by delayed feedback. Considering a model of a wide-aperture laser with a saturable absorber and delayed optical feedback, we demonstrate the appearance of multiple coexistent laser cavity solitons. We show that at large delays apart from the drift and phase instabilities the soliton can exhibit a delay-induced modulational instability associated with the translational neutral mode. The combination of drift and modulational instabilities produces a zigzagging motion of the solitons, which are either periodic, with the period close to the delay time, or chaotic, with low-frequency fluctuations in the direction of the soliton motion. The same type of modulational instability is demonstrated for localized solutions of the cubic-quintic complex Ginzburg-Landau equation.