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DISSIPATIVE SOLITONS IN PASSIVELY MODE-LOCKED FIBER LASERS

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Abstract

We introduce the concept of dissipative solitons , which emerge as a result of a double balance: between nonlinearity and dispersion and also between gain and loss. Such dissipative solitons have many unique properties which differ from those of their conservative counterparts and which make them similar to living things. We focus our discussion on dissipative solitons in fiber lasers, which can be described by the cubic-quintic complex Ginzburg-Landau equation (CGLE). In the field of nonlinear optics, the CGLE can describe also several other systems, namely optical parametric oscillators, free-electron laser oscillators, and all-optical transmission lines.

To fully explore the CGLE, massive numerically simulations must be carried out. Different types of soliton solutions are obtained in this way, which can be divided in two classes: localized fixed-shape solutions and localized pulsating solutions. Among the localized pulsating solutions, we may refer the plain pulsating and the creeping solions, as well as the erupting solitons, which belong to the class of chaotic solutions. The existence of the erupting solitons has been experimentally confirmed in a passively mode-locked solid state laser, where the higher-order effects might have some influence. The possibility of converting the localized pulsating solitons into fixed-shape pulses under the influence of some higher-order effects, as well.

Biography:

Mário F. S. Ferreira graduated in Physics from the University of Porto, Portugal, and received the Ph.D. degree in Physics in 1992 from the University of Aveiro, Portugal, where he is now a Professor at the Physics Department. Between 1990 and 1991 he was at the University of Essex, UK, performing experimental work on external cavity semiconductor lasers and nonlinear optical fiber amplifiers. His research interests have been concerned with the modeling and characterization of multi-section semiconductor lasers for coherent systems, quantum well lasers, optical fiber amplifiers and lasers, soliton propagation, polarization and nonlinear effects in optical fibers

Speaker Publications:

"Optics and Photonics" (Lidel, 2003, in Portuguese), "Topics of Mathematical Physics" (Editora Ciência Moderna, 2018, Brazil, in Portuguese), "Optical Fibers: Technology, Communications and recent Advances" (Ed., NOVA Science Publishers, 2017), and "Nonlinear Effects in Optical Fibers" (John Wiley & Sons, OSA, 2011). He was the Guest Editor of two Special Issues of "Fiber and Integrated Optics" (Taylor & Francis): "Fiber Optics in Portugal" (2005) and "Nonlinear Fiber Optics" (2015), and a Special Issue of "Fibers" (MDPI): "Optical Fiber Communications" (2018). Actually, he is Guest Editor of a Special Issue of "Applied Optics" and "Optics Express" (Optical Society of America): "Optical Sensors and Sensing 2019" (2019).

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