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Predicting the unpredictable with an isomorphic single-control parameter structure of the Laser-Lorenz equations

Belkacem Meziane Université d'Artois, France

L eaning on the extraction of, so far unidentified, recurrent-properties, we put forward an isomorphic structure that converts the Laser-Lorenz equations, whose dynamic solutions are usually described in terms of three independent factors, into a single control-parameter system. Such an isomorphism is shown to bring an intrinsic simplification that offers much better depictions of the Laser non-linear dynamics, while it allows for quicker and forthright inspection of the control-parameter domains, inside which well-defined periodic, symmetric and asymmetric, as well as chaotic solutions occur. The single controlparameter equations will be demonstrated to contain the full nonlinear dynamics of the original set. Functional graphicalrepresentations, with respect to this lone control-parameter, will be shown to depict the complete hierarchy of typical windows, each bearing specific solutions. The objectives of the presentation are threefold. The primary one is to demonstrate, for the first time, that the solutions of the single mode Laser equations possess some repeatedly organized and systematic properties that allow for straightforward identification of its periodic windows, asymmetric and chaotic solutions, following some judicious arrangements of its control-parameters. Based on such endorsement, a second step will naturally end-result to transforming the equations into a single control-parameter set which encloses the same abundant dynamical solutions while preserving the full hierarchies and features of the three-control-parameter system. As a final concern, a summarizing generic map will sum up the predicted solution-windows associated with the single control-parameter variable. Hopefully, such a noteworthy simplification will render non-linear Laser dynamics much easier to apprehend.

Biography

Belkacem Meziane received the MS degree in Electrical Engineering (1978) from the Florida Institute of Technology, Melbourne, USA, the PhD degree (1992) and the "Habilitation à Diriger des Recherches" (1996) from ENSSAT, Université de Rennes I, Lannion, France. From 1979 to 1990, he was a Lecturer at the Algiers-University Physics Department (USTHB), Algeria. From 1990 to 1998, he was a member of the Optronics Division at ENSSAT. In 1999, he's been a tenured Professor at the Faculty of Sciences, Université d'Artois, Lens, France. He is the author of over 30 published papers, including 2 book chapters on laser dynamics.

belkacem.meziane@univ-artois.fr

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