SEMINÁRIO DE EQUAÇÕES DIFERENCIAIS

The NLS equation on a tadpole graph: existence and stability of bound states solutions

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Resumo: The aim of this lecture is to present new spectral tools for studying the orbital stability of standing waves solutions for the nonlinear Schrödinger equation (NLS) with power nonlinearity on a tadpole graph, namely, a graph consisting of a circle with a half-line attached at a single vertex. By considering δ-type boundary conditions at the junction and bound states solutions with a positive two-lobe profile, the main novelty of this paper is at least twofold. Via a splitting eigenvalue method developed by the author, we identify the Morse index and the nullity index of a specific linearized operator around of an $a\ priori$ positive two-lobe state profile for every positive power; and we also obtain new results about the existence and the orbital stability of positive two-lobe bound states at least in the cubic NLS case. To our knowledge, the results obtained are the first in studying positive bound states for the NLS on a tadpole graph by non-variational techniques. In particular, our approach has prospect of being extended to study stability properties of other bound states for the NLS on a tadpole graph or on other non-compact metric graph such as a looping edge graph, as well as, for other nonlinear evolution models on a tadpole graph.