Two remarks on a generalized Davey-Stewartson system

A. Eden, H. A. Erbay*, G. M. Muslu

Department of Mathematics, Bogazici University, Bebek 34342, Istanbul, Turkey;
Department of Mathematics, Isik University, Sile Campus, 34980 Sile, Istanbul, Turkey;
Department of Mathematics, Istanbul Tech. University, Maslak 34469, Istanbul, Turkey
[erbay@isikun.edu.tr]

2000 Mathematics Subject Classification. 35Q55

Many equations can be expressed as a cubic nonlinear Schrödinger (NLS) equation with additional terms, such as the Davey-Stewartson (DS) system [1]. As it is the case for the NLS equation, the solutions of the DS system are invariant under the pseudo-conformal transformation. For the elliptic NLS, this invariance plays a key role in understanding the blow-up profile of solutions, whereas in the hyperbolic-elliptic case of DS system an explicit blow-up profile is obtained via the pseudo-conformal invariance. An analogous system has been derived in [2] to model wave propagation in a generalized elastic medium and has been called Generalized Davey-Stewartson (GDS) system. In [3], for the hyperbolic-elliptic-elliptic and elliptic-elliptic-elliptic cases the GDS system has been expressed as a NLS equation with non-local terms.

We present two results on the GDS system, both following from the pseudo-conformal invariance of its solutions. In the hyperbolic-elliptic-elliptic case, under some conditions on the physical parameters, we establish a blow-up profile. These conditions turn out to be necessary conditions for the existence of a special “radial” solution. In the elliptic-elliptic-elliptic case, under milder conditions, we show the $L^p$-norms of the solutions decay to zero algebraically in time for $2 < p < \infty$.