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An improved IST approach for detection of deep-water solitary wave groups

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When the Inverse Scattering Technique (IST) is applied with the purpose of detection of solitary deep-water wave groups hidden in the field of irregular waves, then the determination of the carrier wavenumber, k_0, is one of the most important steps. It is because the dominant wave length introduces a characteristic scale in the system. The similarity parameter of the nonlinear Schrodinger equation (equivalent of the Benjamin – Feir Index), which characterizes the role of nonlinear effects in comparison to the wave dispersion, is dimensional as $[m^2]$. In fact, an error in the value of the carrier wavenumber results in an error in evaluation of the solitary group amplitude with factor 2. When waves are not very small, and their spectrum is not very narrow, the problem how to calculate the carrier wavenumber becomes crucial. In this study we consider a number of approaches to calculate k_0 on the basis of given examples of momentary snapshots of the surface displacement, looking for the most robust methods. Finally, we suggest a different approach, of a two-step IST procedure, when the carrier wavenumber at the second step is corrected according to the result of analysis at the first step. We show that this approach possesses improved robustness and is much less dependent on the way how the primary value of k_0 is evaluated.