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**Propagation of nonlinear waves over submerged step: wave separation and subharmonic generation** EDUARDO MONSALVE, Laboratoire de Physique et Mécanique des Milieux Hétérogènes, ESPCI - ParisTech, AGNES MAUREL, Institut Langevin, ESPCI - ParisTech, VINCENT PAGNEUX, Laboratoire d'Acoustique de l'Université du Maine, PHILIPPE PETITJEANS, Laboratoire de Physique et Mécanique des Milieux Hétérogènes, ESPCI - ParisTech — Water waves can be described in simplified cases by the Helmholtz equation. However, even in these cases, they present a high complexity, among which their dispersive character and their nonlinearities are the subject of the present study. Using Fourier Transform Profilometry, we study experimentally the propagation of waves passing over a submerged step. Because of the small water depth after the step, the wave enters in a nonlinear regime. In the shallow water region, the second harmonic leads to two types of waves: bound waves which are slaves of the fundamental frequency with wavenumber $2k(\omega)$, and free waves which propagate according to the usual dispersion relation with wavenumber $k(2\omega)$. Because of the presence of these two waves, beats are produced at the second harmonic with characteristic beat length. In this work, for the first time we extended this analysis to the third and higher harmonics. Next, the region after the step is limited to a finite size L with a reflecting wall. For certain frequencies and L- values, the spectral component becomes involved, with the appearance of sub harmonics. This regime is analyzed in more details, suggesting a transition to a chaotic and quasi-periodic wave behavior.

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