Publications-Resonances and Coupling of Surface and Internal Waves: P 33107 N

(1) C. I. Martin. *Some explicit solutions of the three-dimensional Euler equations with a free surface.* **Mathematische Annalen**. 2021, https://doi.org/10.1007/s00208-021-02323-2.

(2) R. I. Ivanov and C. I. Martin. *Hamiltonian approach to modelling interfacial internal waves over variable bottom.* **Physica D: Nonlinear Phenomena**, 433 (2022), 133190.

(3) C. I. Martin. *On three-dimensional free surface water flows with constant vorticity.* **Comm. Pure Appl. Anal.** 21 (2022) no. 7, 2415–2431.

(4) C. I. Martin. *On azimuthally propagating equatorial atmospheric waves.* **Monatshefte für Mathematik**. https://doi.org/10.1007/s00605-022-01741-x

(5) C. I. Martin and R. Quirchmayr. *Exact solutions and internal waves for the Antarctic Circumpolar Current in spherical coordinates.* **Stud. Appl. Math.** 148 (2022), no. 3, 1021–1039.

(6) C. I. Martin and A. Petrusel. *Free surface equatorial flows in spherical coordinates with discontinuous stratification depending on depth and latitude.* **Ann. Mat. Pura Appl.** DOI: 10.1007/s10231-022-01214-w.

(7) C. I. Martin *On flow simplification occurring in viscous three-dimensional water flows with constant non-vanishing vorticity.* **Appl. Math. Lett.** 124 (2022), Paper No. 107690.

(8) B. Basu and C. I. Martin. *An alternative approach to study irrotational periodic gravity water waves.* **Z. Angew. Math. Phys.** 72 (2021), no. 4, Paper No. 155.

(9) L. Chen, B. Basu and C. I. Martin. *On rotational flows with discontinuous vorticity beneath steady water waves near stagnation*, **J. Fluid Mech** 912 (2021), A44.

(10) C. I. Martin. *Azimuthal equatorial flows in spherical coordinates with discontinuous stratification*, **Physics of Fluids**. 33 (2021), 026602.

Obtained Results

(i) Derivation in [1] of a family of **explicit solutions to the three-dimensional Euler equation with a free surface**. These solutions were shown to be also stable by means of a WKB-type analysis.

(ii) Derivation in [5,6,10] of exact solutions describing **geophysical flows with discontinuous stratification and internal waves**.

(iii) Derivation in [4] of **explicit solutions describing atmospheric waves**.

(iv) A study [2] of the **effects of a variable bottom on the internal wave propagation in the presence of stratification and underlying non-uniform currents**. This situation is illustrated by equatorial internal waves in the presence of the Equatorial Undercurrent (EUC). The interface (physically coinciding with the thermocline and pycnocline) was found to satisfy (in the long wave approximation) a KdV-mKdV type equation variable coefficients. Moreover, the soliton propagation over variable depth leads to effects such as soliton fission, which is analyzed and studied numerically as well.

(v) **Rigidity-type results for three-dimensional water flows** with [7] and without viscosity [3].

(vi) **Numerical investigation of the flow structure of periodic steady water waves propagating on rotational flows with piecewise constant vorticity and allowing**

for stagnation points. We found that the stagnation point can occur first internally or at the bottom, and then again at the crest with further increase in wave-height. We presented also an in-depth discussion about the pressure distribution and particle trajectories beneath large-amplitude steady waves near stagnation.