Explicit Asymptotics for Waves and Vortices with Small Amplitudes on the Shallow Water Created by Localized Sources and their Applications

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Using recently developed method for construction of localized asymptotic solutions to linear hyperbolic systems we present a wide range of simple asymptotic solutions describing in linear approximation the propagation of waves and vortices on the shallow water over nonuniform bottom generated by sources localized in space and in time. Our consideration includes cases when focal points appear on the fronts of waves and also the interaction of the waves with the beach (linear 1-D and 2-D run-up problems). We discuss a possibility of using these solutions in 1-D nonlinear situations and applications to tsunami wave problems.

Bibliography

[1] S.Yu. Dobrokhotov, S.Ya Sekerzh-Zenkovich, B. Tirozzi, T.Ya.Tudorovskiy, The description of tsunami waves propagation based on the Maslov canonical operator, Doklady Mathematics, 74, No. 1, (2006), pp. 592-596.

[2] S.Yu. Dobrokhotov, S.Ya Sekerzh-Zenkovich, B. Tirozzi, B.Volkov, Explicit asymptotics for tsunami waves in framework of the piston model, Russ. Journ. Earth Sciences, 8, ES403, 1-12 (2006)

[3] S.Yu. Dobrokhotov, A.I.Shafarevich, B. Tirozzi, Localized Wave and Vortical Solutions to Linear Hyperbolic Systems and Their Application to the Linear Shallow Water Equations, Russ.J.Math.Phys. v. 15, N 2,(2008),pp.192-221

[4] S.Yu.Dobrokhotov, B.Tirozzi, C.A.Vargas, Behavior near the focal points of asymptotic solutions to the Cauchy problem for linearized Shallow water equations with initial localized perturbation, Russ.J.Math.Phys. v.16, N 2,(2009), pp.192-221

[5] S.Yu. Dobrokhotov, V.E.Nazaikinskii, B. Tirozzi, Asymptotic solutions of 2-D wave equations with variable velocity and localized right-hand side, Russ. Jour.Math.Phys., v.17, N 1, 2010, pp.66-76.

[6] S.Yu. Dobrokhotov, B. Tirozzi, Localized solutions of one-dimensional non-linear shallow-water equations with velocity c =\sqrt(x), Russ. Math .Surveys, vol.65, No.1, pp. 157–158

[7] S.Yu. Dobrokhotov, V.E.Nazaikinskii, B. Tirozzi, Asymptotic solutions of the 2-D model wave equation with degenerated velocity and localized initial data, Algebra i Analiz (St.Petersburg Math.J.), 2010, v.22 N 6, pp. 67–90