



Nonlinear waves in special coordinates

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Computer algebra system is applied for studying the waves behavior in a circular basin within quadratic approximation. When the polar coordinates are used, the usual perturbation techniques in separation of variables method inevitably leads to a series of overdetermined systems of linear algebraic equations for the unknown coefficients (in contrast with the Cartesian coordinates). However, if we introduce formally a solution of the first system of this series, all these overdetermined systems become compatible for the special case of the nonlinear acoustical wave equation. Using the added solution and quadratic polynomials of the Bessel functions of radius, we express explicitly the coefficients of the first two harmonics. It gives solutions describing two waves interaction which are found with the same accuracy as the nonlinear equation is derived. The case elliptic basin where the Mathieu functions arise is also considered. This is a generalization of results given in [1], where it was proved that nonlinear monochromatic waves are described by quadratic polynomials of Bessel functions. This approach was used in [2] for describing the long periodic water waves on a slope in the high-order shallow water approximation. [1] Shermenev, A. Separation of variables for the nonlinear wave equation in cylindrical coordinates. *Physica D: Nonlinear Phenomena*, 212:3-4(2005) pp 205-215. [2] Shermenev, A. 2003 *Nonlinear Periodic Waves in Shallow Water*. LNCS 2630, Springer-Verlag, pp 375–386.