NONLINEAR ACOUSTICAL EQUATION IN THE CYLINDER COORDINATES

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An interaction of two acoustical waves in a cylinder is studied within quadratic weakly nonlinear approximation. When the cylinder coordinates are used, the usual perturbation techniques in separation of variables method inevitably lead to a series of overdetermined systems of linear algebraic equations for the unknown coefficients (in contrast with the Cartesian coordinates). However, if we formally introduce a new function satisfying the first system of this series, all these overdetermined systems become compatible (remaining overdetermined) for the special case of the nonlinear acoustical wave equation. Using the new function and quadratic polynomials of the Bessel functions of radius, we explicitly express the coefficients of the resulting harmonics. It gives solutions describing two-waves interaction which are found with the same accuracy as the nonlinear acoustical equation is derived. As a consequence, a general boundary problem can be explicitly solved in these terms.

References

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