

Singular solutions of Protter problems for the wave equation

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Abstract

Boundary value problems introduced by M. H. Protter for the nonhomogeneous wave equation are studied in a (3+1)-D domain, bounded by two characteristic cones and a non-characteristic ball. They could be considered as multidimensional analogues of the Darboux problem in the plane. However, unlike the Darboux problem, its four-dimensional analogue is not well posed. In the frame of classical solvability the Protter problem is not Fredholm, because it has an infinite-dimensional cokernel. Alternatively, it is known that the unique generalized solution of a Protter problem may have a strong power-type singularity at the vertex O of the boundary light cone. It is interesting that the singularity is isolated at the point O and does not propagate along the bicharacteristics. We present some conditions on the smooth right-hand side functions that are sufficient for existence of a generalized solution and give some a priori estimates for its possible singularity.

REFERENCES

- [1] N.Popivanov, T.Popov, A.Tesdall, Semi-Fredholm solvability in the framework of singular solutions for the (3+1)-D Protter-Morawetz problem, Abstract and Applied Analysis, Volume 2014, Article ID 260287, 19 p.