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ON A NONLOCAL BOUNDARY VALUE PROBLEM WITH INTEGRAL CONDITIONS FOR A FRACTIONAL TELEGRAPH EQUATION

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In this paper, we study a nonlocal boundary value problem for a generalized telegraph equation with fractional derivatives. Fractional differentiation is specified using the Caputo operator. The equation is considered in a bounded rectangular domain of the plane of two independent variables. Nonlocal boundary conditions are specified in the form of partial integral expressions from the desired solution for each of the variables with given continuous kernels. Using the previously obtained representation for the solution of the Goursat problem for the equation under study in terms of the Wright-type function, the problem under consideration can be reduced to the system of Volterra linear integral equations with respect to the traces of the desired solution on the part of the boundary of the domain. As a result, a theorem on the existence and uniqueness of a solution to the problem under study is proved; its representation is found in terms of solutions to the resulting system of integral equations.

Keywords: non-local problem, Caputo derivative, fractional telegraph equation, integral condition, Wright-type function.

REFERENCES

1. Nakhushev A.M. *Drobnoye ischisleniye i yego primeneniye* [Fractional calculus and its application]. M.: Fizmatlit, 2003. 272 p.

2. *Cascaval R.C., Eckstein E.C., Frota C.L., Goldstein J.A.* Fractional telegraph equations // Journal of Mathematical Analysis and Applications. 2002. Vol. 276. № 1. Pp. 145-159.

3. Pskhu A.V. *Krayevaya zadacha dlya differentsial'nogo uravneniya s chastnymi proizvodnymi drobnogo poryadka* [A boundary value problem for a fractional differential equation with partial derivatives] // News of the Kabardino-Balkarian Scientific Center of the Russian Academy of Sciences. 2002, No. 1. Pp. 76-78.

4. Mamchuev M.O. *Obshcheye predstavleniye resheniy drobnogo telegrafnogo uravneniya* [General representation of solutions of the fractional telegraph equation] // Reports of Adyghe (Circassian) International Academy of Sciences. 2014, T. 16. No. 2. Pp. 47-51.

5. Pshibikhova R.A. An analogue of the Goursat problem for a generalized telegraph equation of fractional order // Differential equations. 2014. V. 50. No. 6. Pp. 839-843.

6. Eremin A.S. *Tri zadachi dlya odnogo uravneniya v chastnykh drobnykh proizvodnykh / Trudy Vserossiyskoy nauchnoy konferentsii «Differentsial'nyye uravneniya i krayevyye zadachi». Chast' 3. Matematicheskoye modelirovaniye i krayevyye zadachi* [Three problems for a single partial fractional equation, Proceedings of the All-Russian Scientific Conference, Differential equations and boundary value problems. Part 3. Mathematical modeling and boundary value problems]. Samara State Technical University. Samara 2004. Pp. 94-98.

7. Pshibikhova R.A. *Zadacha Gursa dlya drobnogo telegrafnogo uravneniya s proizvodnymi Kaputo i s integral'nym usloviyem* [The Goursat problem for a fractional telegraph equation with Caputo derivatives and with an integral condition] // News of the Kabardino-Balkarian Scientific Center of the Russian Academy of Sciences. 2016. No. 4 (70). Pp. 25-29.

8. Pshibikhova R.A. The Goursat problem for a fractional telegraph equation with Caputo derivatives // Mathematical Notes 2016. Vol. 99. No. 4. Pp. 559-563.

9. Pskhu A.V. *Uravneniya v chastnykh proizvodnykh drobnogo poryadka* [Partial differential equations of fractional order]. M.: Science, 2005. 199 p.

10. *Kilbas A.A., Srivastava H.M., Trujillo J.J.* Theory and Applications of Fractional Differential Equations. North-Holland Math. Stud. 204. Elsevier. Amsterdam, 2006.

11. Smirnov V.I. *Kurs vysshey matematiki* [Course in higher mathematics]. V. 5. M.: Fizmatgiz, 1959.

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