

Exact solution of local and nonlocal BVPs for the Laplace equation in a rectangle

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It is proposed an operational calculus method for obtaining explicit solutions of a class of local and nonlocal BVPs for the Laplace equation. It is based on direct two-dimensional operational calculi built on two non-classical convolutions for the operators ∂_{xx} and ∂_{yy} . The corresponding operational calculi use multiplier fractions instead of convolution fractions. An extension of the Duhamel principle to the space variables is proposed. Thus is obtained explicit solutions of BVPs considered, especially the Dirihlet problem. In fact, the explicit solution obtained is a way for effective summation of a solution obtained in the form of non-harmonic Fourier sine-expansion. This explicit representation may be used both for theoretical study, and for numerical calculation of the solution too. Comparison with the existing methods is made. The general approach is specialized to the case when some of the boundary value conditions are of integral and Bitsadze-Samarskii type.

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