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Functional Analytic Framework of the Fokas Method for Elliptic Boundary Value Problems

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Abstract

We give an overview of the functional analytic framework for the Fokas approach to elliptic boundary value problems in convex planar domains. The global relation can be interpreted as an operator equation of the form $Ax = y$, where y depends on the known data of a given boundary value problem and x corresponds to the unknown boundary values. We study the functional analytic properties of the operator $A : X \rightarrow Y$ where X, Y are Banach spaces of complex analytic functions that are similar to the classical Paley-Wiener spaces. These results are important, not only from a theoretical perspective, but are essential for establishing convergence and stability results for the numerical implementation of this approach to boundary value problems. Finally, we give a brief account of some recent results that are applicable to elliptic boundary value problems in three dimensional polyhedra.

Key words: Fokas Method, Boundary Value Problems, Functional Analysis, Operator Theory.