An application of generalized finite differences to unsteady heat problems subject to mixed boundary conditions

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ABSTRACT

In this paper we present the application of a generalized finite difference Crank-Nicolson scheme to the numerical solution of the unsteady heat equation in $2+1$ dimensions subject to mixed Dirichlet and Robin conditions, a problem which has not been extensively studied when the spatial domain has an irregular shape. The generalized scheme is based on a second order difference scheme defined by an optimality condition, and it has been developed to solve Poisson-like equations whose domains are approximated by structured convex grids over very irregular regions generated by the direct variational method. Numerical examples showing the accuracy of the method are presented.

REFERENCES

[1] P. Barrera-Sánchez, J. Cortés, F. Domínguez-Mota, G. González-Flores, J. G. Tinoco-Ruiz, "Smoothness and Convex Area Functionals-revisited", *SIAM Journal on Scientific Computing*, **32**, 1913-1918 (2014).

[2] F. Domínguez-Mota, S. Mendoza-Armenta, J. G. Tinoco-Ruiz, "Finite difference schemes satisfying an optimality condition", *MASCOT 2010 Proceedings, IMACS Series (ISBN 1098-870X)*, **1**, 101-110 (2011).

[3] F. Domínguez-Mota, S. Mendoza-Armenta, J. G. Tinoco-Ruiz, G. Tinoco-Guerrero, "Numerical solution of Poisson-like equations with Robin boundary conditions using a finite difference scheme defined by an optimality condition", *MASCOT 2011 Proceedings, IMACS Series (ISBN 1098-870X)*, **1**, 101-110 (2013).