$O(h^8 |\ln h|)$ order of accurate difference method for solving the Dirichlet problem for Laplace's equation on a rectangle with boundary values in $C^{k,1}$

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Abstract: A three stage (9-point, 5-point and 5-point) difference method for solving the Dirichlet problem for Laplace's equation on a rectangle is proposed and justified. It is proved that the proposed difference solution converges uniformly to the exact solution of order $O(h^8 |\ln h|)$, h is the mesh size, when the boundary functions are from $C^{9,1}$. Numerical experiment is illustrated to support the analysis made.

Keywords: finite difference method, error estimations, highly accurate methods

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