Fundamental mode exact schemes for nonstationary problems

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The problem of increasing the accuracy of an approximate solution is considered for boundary value problems for parabolic equations. For ordinary differential equations (ODEs), nonstandard finite difference schemes are in common use for this problem. They are based on a modification of standard discretizations of time derivatives and, in some cases, allow to obtain the exact solution of problems. For multidimensional problems, we can consider the problem of increasing the accuracy only for the most important components of the approximate solution. In the present work, new unconditionally stable schemes for parabolic problems are constructed, which are exact for the fundamental mode. Such two-level schemes are designed via a modification of standard schemes with weights using Padé approximations. Numerical results obtained for a model problem demonstrate advantages of the proposed fundamental mode exact schemes.