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ON FINITE ELEMENT PROCEDURES OF HIGH ORDER ACCURACY FOR PARABOLIC EQUATIONS

by IVAN HLAVÁČEK

The lecture contained a summary of an article, which has been published under the title: "*On a semi-variational method for parabolic equations*" in Aplikace matematiky, 17 (1972), 5, 327—351 and 18 (1973), 1.

Much work has been done on a special Galerkin-type procedure with the error estimate $O(h^m + \tau^2)$, which is similar to the Crank–Nicholson finite-difference scheme (denoting the spatial mesh size by h and the time increment by τ). In the lecture, a sequence of approximations was presented for the solution of linear inhomogeneous abstract parabolic equations, possessing an increasing accuracy in τ.

The first approximation coincides with the procedure mentioned above. For the second approximation, the rate of convergence $O(h^m + \tau^4)$ can be proved. The n-th approximation of the solution to a homogeneous equation agrees with the Padé matrix approximation at the basic time instants. It is independent of the choice of polynomial bases in the time coordinate interval. The procedure can be easily arranged so that the advantage of band matrices is preserved.

The method has been extended to inhomogeneous boundary conditions and to equations with two positive definite operators. On some numerical examples the efficiency of the second approximation has been compared with that of Crank–Nicholson–Galerkin procedure.

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