Convergence Analysis of Cubic B-Spline Collocation Method for Time Dependent Parabolic Advection-Diffusion Equations

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Abstract : A comprehensive numerical study is presented for the solution of time-dependent advection diffusion problems by using cubic B-spline collocation method. The linear combination of cubic B-spline basis, taken as approximating function, is evaluated using the zeros of shifted Chebyshev polynomials as collocation points in each element to obtain the best approximation. A comparison, on the basis of efficiency and accuracy, with the previous techniques is made which confirms the superiority of the proposed method. An asymptotic convergence analysis of technique is also discussed, and the method is found to be of order two. The theoretical analysis is supported with suitable examples to show second order convergence of technique. Different numerical examples are simulated using MATLAB in which the 3-D graphical presentation has taken at different time steps as well as different domain of interest.