Improved Accuracy for Locally One-Dimensional Methods for Parabolic Equations Based on Mixed Finite Element Procedures

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Classical alternating direction (AD) methods for parabolic equations, based on some standard implicit time stepping procedure such as Crank-Nicolson, can have errors associated with the AD perturbations that are much larger than the errors associated with the underlying time stepping procedure . We show that minor modifications in the AD procedures can virtually eliminate the perturbation errors at an minor additional computational cost. A mixed finite element method is applied in the spactial variables. Similar to the finite difference and finite element methods in spactial variables, we have the same accuracy in time. A convergence analysis can also be shown .

Keywords: Alternating direction method, mixed finite element methods.