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## 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 spacial variables. Similar to the finite difference and finite element methods in spacial variables, we have the same accuracy in time. A convergence analysis can also be shown.

**Keywords:** Alternating direction method, mixed finite element methods.