# A Monotone Numerical Scheme with Truncation Errors Being Finite but Arbitrary Small Based on Finite Variable Difference Method

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**Abstract:**

We discuss a numerical scheme with monotonicity preserving properties without additionally introducing artificial diffusions for advection- diffusion equations. This paper proposes a numerical scheme based on "Finite Variable Difference Method (FVDM)", in which the convection term is discretized by using locally optimized numerical fluxes so that the resulting difference equation may satisfy a locally exact solution of steady advection- diffusion equations. The present scheme ensures the monotonicity up to the cell Reynolds number $Rm = 3$ with the third-oder accuracy and for $3 \leqq Rm < 3.4$ with the second-oder accuracy, while the conventional central scheme and the QUICK scheme up to $Rm = 2$ and $Rm = 8/3$, respectively. For $Rm > 3.4$, though the present scheme has the first-order accuracy, the lowest order of its truncation error can be finite but arbitrary small. Numerical experiments show solutions with good quality.