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非线性Sine-Gordon方程Hermite型有限元新的超收敛分析及外推

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A New Superconvergence Analysis and Extrapolation of Hermite-type Finite Element for Nonlinear Sine-Gordon Equations

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摘要 在半离散格式下讨论了一类非线性Sine-Gordon方程的Hermite型矩形元逼近. 利用该元的高精度分析和对时间t的导数转移技巧, 得到了H^1模意义下$O(h^2)$阶的最优误差估计和$O(h^3)$阶的超逼近性. 进一步地, 通过运用插值后处理方法, 给出了超收敛结果. 与此同时, 借助于构造一个新的外推格式, 导出了与线性情形相同的$O(h^4)$阶外推解.

关键词: Sine-Gordon方程   Hermite型矩形元   超逼近和超收敛   外推

Abstract: An Hermite-type rectangular element approximation is discussed for a class of nonlinear Sine-Gordon equations under semi-discrete scheme. The optimal error estimate with order $O(h^2)$ and the superclose property with order $O(h^3)$ in H^1 norm are derived by use of high accuracy analysis of the element and the derivative transfering technique with respect to the time t. Moreover, the superconvergence result is obtained by the interpolation post-processing method. At the same time, the extrapolation solution with order $O(h^4)$ is deduced through constructing a new extrapolation scheme, which is as same as that of the linear case.

Key words: Sine-Gordon equations   Hermite-type rectangular element   superclose and superconvergence   extrapolation

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