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Asymptotic Behavior for Discretizations of a Semilinear Parabolic Equation with a Nonlinear Boundary Condition

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Abstract: This paper concerns the study of the numerical approximation for the following initial-boundary value problem:

$$\begin{cases} u_t = u_{xx} - a|u|^{p-1}u, & 0 < x < 1, t > 0, \\ u_x(0, t) = 0 \quad u_x(1, t) + b|u(1, t)|^{q-1}u(1, t) = 0, & t > 0, \\ u(x, 0) = u_0(x) > 0, & 0 \leq x \leq 1, \end{cases} \quad (P)$$

where $a > 0$, $b > 0$ and $q > p > 1$. We show that the solution of a

semidiscrete form of (P) goes to zero as t goes to infinity and give its asymptotic behavior. Using some nonstandard schemes, we also prove some estimates of solutions for discrete forms of (P). Finally, we give some numerical experiments to illustrate our analysis.



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