NUMERICAL BLOW-UP SOLUTIONS FOR SOME SEMILINEAR HEAT EQUATIONS[*]

FIRMIN K. N'GOHISSE[†] AND THEODORE K. BONI[‡]

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

$$u_t = u_{xx} + \frac{b}{x}u_x + u^p, \quad x \in (0, 1), \quad t \in (0, T),$$
$$u_x(0, t) = 0, \quad u(1, t) = 0, \quad t \in (0, T),$$
$$u(x, 0) = u_0(x), \quad x \in [0, 1],$$

where $b > 0$ and $p > 1$. We give some conditions under which the solution of a semidiscrete form of the above problem blows up in a finite time and estimate its semidiscrete blow-up time. Under some assumptions, we also show that the semidiscrete blow-up time converges to the continuous blow-up time when the mesh size goes to zero. Finally, we give some numerical results to illustrate our analysis.

Key words. semidiscretizations, discretizations, semilinear heat equations, semidiscrete blow-up time

AMS subject classifications. 35B40, 35K65, 65M06

[†]Universite d'Abobo-Adjame, UFR-SFA, Departement de Mathematiques et Informatiques, 02 BP 801 Abidjan 02, Cote d'Ivoire (firmingoh@yahoo.fr).

[‡]Institut National Polytechnique Houphouet-Boigny de Yamoussoukro, BP 1093 Yamoussoukro, Cote d'Ivoire (theokboni@yahoo.fr).