

# A FINITE VOLUME SCHEME FOR A PARABOLIC-ELLIPTIC PROBLEM

RAIMUND BÜRGER, RAFAEL ORDOÑEZ, MAURICIO SEPÚLVEDA, AND LUIS M. VILLADA

**ABSTRACT.** We study the well-posedness of a coupled Parabolic-Elliptic system of equations using the well known smoothing properties of the Neumann heat semigroup  $(e^{t\Delta})_{t \geq 0}$  on a domain  $\Omega$  (cf. [3]). Furthermore, we introduce some notations for a finite volume method and present our numerical scheme, an a priori estimate and the main theorem of existence of a solution to the finite volume scheme. Finally, we report some numerical tests illustrating the behavior of the solution of the finite volume scheme.

**Keywords:** Heat semigroup, finite volume method.

**Mathematics Subject Classifications (2010):** 65M08, 35K91

## REFERENCES

- [1] V. Anaya, M. Bendahmane, M. Langlais, M. Sepúlveda, Mauricio, A convergent finite volume method for a model of indirectly transmitted diseases with nonlocal cross-diffusion, *Computers & Mathematics with Applications*. **70** (2015), 132–157
- [2] B. Andreianov, M. Bendahmane, R. Ruiz-Baier, Analysis of a finite volume method for a cross-diffusion model in population dynamics, *Math. Models and Methods Appl. Sci.* **21** (2011), 307–344
- [3] P. Quittner, P. Souplet, Superlinear parabolic problems: blow-up, global existence and steady states, *Springer Science & Business Media*. (2007)

CI<sup>2</sup>MA AND DEPARTAMENTO DE INGENIERÍA MATEMÁTICA, UNIVERSIDAD DE CONCEPCIÓN.  
*E-mail address:* rburger@ing-mat.udec.cl

CI<sup>2</sup>MA AND DEPARTAMENTO DE INGENIERÍA MATEMÁTICA, UNIVERSIDAD DE CONCEPCIÓN.  
*E-mail address:* rordonez@ing-mat.udec.cl

CI<sup>2</sup>MA AND DEPARTAMENTO DE INGENIERÍA MATEMÁTICA, UNIVERSIDAD DE CONCEPCIÓN.  
*E-mail address:* mauricio@ing-mat.udec.cl

CI<sup>2</sup>MA AND DEPARTAMENTO DE MATEMÁTICAS, UNIVERSIDAD DEL BÍO-BÍO.  
*E-mail address:* lvillada@ubiobio.cl