Łochów, 23rd–27th September 2014

THE METHOD OF LINES FOR TERNARY DIFFUSION PROBLEMS

Henryk Leszczyński

Institute of Mathematics, University of Gdańsk
Wita Stwosza 57, 80-952 Gdańsk,
[1]hleszcz@mat.ug.edu.pl

ABSTRACT

The method of lines (MOL) for diffusion equations with Neumann boundary conditions is considered:

$$\begin{aligned}\frac{\partial u}{\partial t} &= D_1 \frac{\partial^2 u}{\partial x^2} - \frac{\partial}{\partial x}\left(u\, v^D\right)\\ \frac{\partial v}{\partial t} &= D_2 \frac{\partial^2 v}{\partial x^2} - \frac{\partial}{\partial x}\left(v\, v^D\right)\\ \frac{\partial w}{\partial t} &= D_3 \frac{\partial^2 w}{\partial x^2} - \frac{\partial}{\partial x}\left(w\, v^D\right)\end{aligned} \tag{1}$$

These equations are transformed by a discretization in space variables into systems of ordinary differential equations. The proposed ODE's satisfy the mass conservation law. The stability of solutions of these ODE's with respect to discrete L^2 norms and discrete $W^{1,\infty}$ norms is investigated. Numerical examples confirm the parabolic behaviour of this model and very regular dynamics. Our research (published in [1]) is based on the ideas from [2]. The system is strongly coupled and nonlinear.

ACKNOWLEDGEMENTS

This work is supported by the Foundation for Polish Science DEC-2011/02/A/ST8/00280.

REFERENCES

[1] H. Leszczyński and M. Matusik: *The Method of Lines for Ternary Diffusion Problems*, Abstract and Applied Analysis **2014** (2014), 10, Article ID 517285, doi:10.1155/2014/517285.

[2] M. Danielewski, K. Holly, and W. Krzyżański: *Interdiffusion in r-Component ($r \geq 2$) one dimensional mixture showing constant concentration*, Computer Methods in Mat. Sci. **8** (2008), 31–46.