

Studying stability properties of the Richardson Extrapolation

Z. Zlatev^a, I. Faragó^b, Á. Havasi^c

^a National Environmental Research Institute, Denmark, E-mail: zz@dmu.dk

^b Eötvös Loránd University, Hungary, E-mail: faragoics@cs.elte.hu

^c Eötvös Loránd University, Hungary, E-mail: hagi@nimbus.elte.hu

The application of the Richardson Extrapolation in the numerical solution of systems of ordinary differential equations (ODEs) usually results in an increase of the accuracy of the calculated approximations, but may sometimes cause stability problems. Therefore, it is often not only desirable, but also necessary to study carefully the stability when Richardson Extrapolation is to be applied.

Seven numerical algorithms for solving systems of ODEs have been selected. These algorithms are used in different modules of the large-scale environmental model UNI-DEM ([1]). It is worthwhile to note that this model has been applied to study pollution levels in many European countries, including Hungary ([2], [3], [4]).

The selected numerical algorithms are used either directly or together with some splitting procedures. Additionally, the Richardson Extrapolation can be used in an attempt to obtain more accurate results. The stability properties of the combined numerical method, consisting of one of the selected algorithms for solving systems of ODEs + some splitting procedure + Richardson Extrapolation, are discussed.

- [1] Z. Zlatev and I. Dimov, Computational and Numerical Challenges in Environmental Modelling. Elsevier, Amsterdam, Boston-Heidelberg, London, New York, Oxford, Paris, San Diego, San Francisco, Singapore, Sydney, Tokyo, **2006**.
- [2] Á. Havasi, L. Bozó and Z. Zlatev, Model simulation on transboundary contribution to the atmospheric sulfur concentration and deposition in Hungary, *Időjárás* **2001**, *105*, 135-144.
- [3] Á. Havasi and Z. Zlatev, Trends in Hungarian air pollution levels on a long time-scale, *Atmospheric Environment* **2002**, *36*, 4145-4156.
- [4] Z. Zlatev, Á. Havasi and I. Faragó, Influence of climatic changes on pollution levels in Hungary and its surrounding countries, *Atmosphere* **2011**, *2*, 201-221.