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CORRIGENDUM

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Volume **116,** Number 1 (1995), in the article "Symbolic-Numerical Method for the Stability Analysis of Difference Schemes on the Basis of the Catastrophe Theory," by E. V. Vorozhtsov, B. Yu. Scobelev, and V. G. Ganzha, pages 26–38: In our paper [1], we presented a new symbolic-numerical method for the stability analysis of difference initial-value problems approximating initial-value problems for hyperbolic or parabolic partial differential equations. The method itself is described in Sections 2–4. A feature of this method is that it is completely automatic and requires no user intervention in the process of its execution on a computer. In Section 5 we present three examples illustrating our method. Example 3 is the two-cycle MacCormack scheme approximating the 2D advection equation. This is the most complex scheme among the examples considered in the paper.

During an IMACS Conference at Albuquerque on May 16–19, 1995, H. Hong presented two of us (E.V.V. and V.G.G.) with a copy of his paper [2], in which he has studied the stability of the same scheme with the aid of the *quantifier elimination method.* He has obtained the necessary stability condition for the two-cycle MacCormack scheme in the form

$$\kappa_1^{2/3} + \kappa_2^{2/3} \leq 1 \tag{1}$$

(the notations are the same as in our paper). The corresponding necessary stability region differs from that depicted in Fig. 6 of [1]. We have studied the reason for this and have found an error in one of the lines of our REDUCE program, which eliminates the intermediate steps from the scheme under consideration to obtain a symbolic expression for the right-hand side of (5.24) of [1]. This error was due to the fact that we did not take into account certain peculiarities of the REDUCE system syntax. After the correction of this error we have obtained a new difference equation (5.24) involving 105 monomials, of which about 10 monomials were different from the old expressions.

The analytic study of the corresponding characteristic equation of scheme (5.24) at points ($\kappa_1 = \pm 1$, $\kappa_2 = 0$), ($\kappa_1 = 0$, $\kappa_2 = \pm 1$) shows that at $\xi_1 = \xi_2 = \pi$ these points may belong to the boundary of the necessary stability region. With the aid of the symbolic-numerical method described in our paper we have then computed the necessary stability region on the basis of the new characteristic polynomial. The obtained numerical results (see Fig. 1) coincide with the analytical result (1) presented in [2]. Our numerical result is shown in Fig. 1 by a thick line, and the result (1) of Hong is shown by a thin line. It is seen that the curves practically coincide. The generation of the main part of the LaTeX file corresponding to Fig. 1 was performed automatically with the aid of special FORMAT operators, which we have inserted in our FORTRAN code implementing the numerical stages of our symbolic-numerical method.

The input of the difference scheme into our REDUCE program remains a loophole for errors, because it is always done by a human. Because of such errors, we have studied in [1] the stability of another difference scheme, and for that scheme our results are correct.

The following measures can be proposed to prevent errors at the stage of the input of a complex difference scheme:

(a) The use of a "scheme checker," which was presented by two of us (V.G.G. and E.V.V.) at the above-

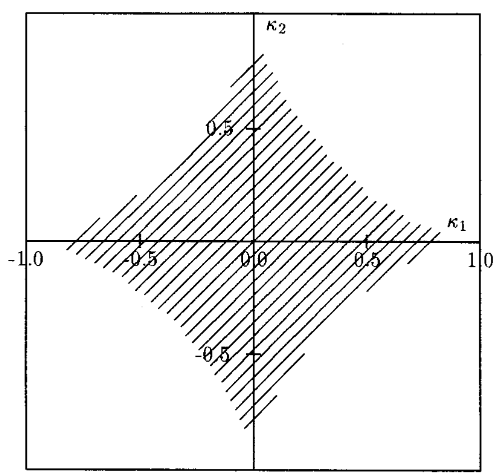

FIGURE 1

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mentioned IMACS Conference (the electronic proceedings of this conference are available via the conference organizers S. Steinberg and M. Wester).

(b) The use of another computer algebra system (CAS). In the case under consideration we have indeed used the CAS *Mathematica* by S. Wolfram to check the correctness of the difference equation obtained by our corrected REDUCE program, and we have obtained the same result.

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REFERENCES

1. E. V. Vorozhtsov, B. Yu. Scobelev, and V. G. Ganzha, *J. Comput. Phys.* **116,** 26 (1995).
2. H. Hong, submitted for publication.