Peer Review

Review of: "Algorithmic Resilience Under Resource Constraints: The Novosibirsk School and the Method of Fractional Steps (1955–1975)"

Quang A. Dang[1]

1. Computer Science, Thai Nguyen University, Thái Nguyên, Vietnam

The paper examines the development of operator splitting methods in the Soviet Union during the 1955-1975 period, with a focus on the Fractional Steps Method (FSM) of Yanenko at the Siberian Branch of the USSR Academy of Science, which was presented in the monograph [4] published in Russian in 1967, anf after that was translated into French in 1968, into German in 1969, and into English in 1970. During the same period, similar techniques were developed in the West by Peaceman, Rackford, Douglass, and so on under the name Alternating Directions Implicit (ADI) methods. The essence of FSM and ADI methods is to reduce complex multi-dimensional problems to a sequence of one-dimensional problems which can be simply solved by the progonka (or Sweep) method in the Soviet literature and the Thompson or Factorization method in the Western literature. The present paper gives an overview of the history of FSM of the Soviet school of numerical mathematics for solving complex multi-dimensional problems of mechanics and physics. I think the author gives a picture of the creation of the method in the context of computational resource constraints. He also provides interesting information about this computational context in the USSR during the period. Some inaccuracies in mathematical formulas are revealed below:

The author uses a 3D equation for illustrating the idea of the ADI method. If so, formula (1) is not OK. Instead of this, it should be

$$\begin{aligned}
\frac{u^{n+1/3}-u^n}{\Delta t/3} &= \kappa(\Lambda_1 u^{n+1/3}+\Lambda_2 u^n+\Lambda_3 u^n)\\
\frac{u^{n+2/3}-u^{n+1/3}}{\Delta t/3} &= \kappa(\Lambda_1 u^{n+1/3}+\Lambda_2 u^{n+2/3}+\Lambda_3 u^{n+1/3})\\
\frac{u^{n+1}-u^{n+2/3}}{\Delta t/3} &= \kappa(\Lambda_1 u^{n+2/3}+\Lambda_2 u^{n+2/3}+\Lambda_3 u^{n+1}),
\end{aligned}$$

 doi.org/10.32388/3B7X3Q

where $\Lambda_1, \Lambda_2, \Lambda_3 $ are central difference approximations of $\frac{\partial ^2 u}{\partial x^2}, \frac{\partial ^2 u}{\partial y^2}, \frac{\partial ^2 u}{\partial z^2}$, respectively.

The author must also explain clearly the idea of the operator splitting method of Yanenko rather than writing the formulas (3), (4).

Declarations

Potential competing interests: No potential competing interests to declare.