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Book of Abstracts

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Study of the convergence of computer calculations

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The problem of reliability of computer calculations is one of the fundamental problems of Computer Science, as it lies at the intersection of applied mathematics on the one hand, and physical and technical limitations of computer technology on the other.

Physical limitations of the amount of memory allocated by computer technology for storing and processing numbers impose fundamental limitations on the possibilities and logic of organizing computer calculations, which also requires the use of rather specific and non-obvious mathematical research methods.

It was considered the mathematical object that was given by Z.-M. Muller and co-authors in the fundamental work [1], devoted to the problem of applied computer calculations. This is a nonlinear inhomogeneous second-order recurrence equation, which we will call the Muller's recurrent sequence:

$$\begin{cases} u(n) = 111 - \dfrac{1130}{u(n-1)} + \dfrac{300}{u(n-1)\cdot u(n-2)}, \\ u(0) = 2, u(1) = -4. \end{cases}$$

As a result of the research, a mathematical justification of the problem of unstable initial values was built and a formula for checking the initial values for the considered sequence was derived.

It was also proved the convergence of Muller's recurrent sequence using the method of mathematical induction, and that although the investigated sequence coincides, a significant error occurs during computer calculations of the members of the sequence.

Bibliography

[1] J.-M. Muller et al. *Handbook of Floating-Point Arithmetic*, Birkhauser, Boston - Basel - Berlin, 2018.

Platform for Digitization of Heterogeneous Documents

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The digitization platform is a web/desktop application written in Python and Javascript, which integrates the processing stages of heterogeneous documents into a digitization cycle, consisting of the following main steps: uploading images or/and PDF files, image preprocessing, optical recognition of characters in the image, checking and editing of recognized text, transliteration of text after checking the recognized text, checking and editing the transliterated text and finally saving the results to the database and/or downloading them. These steps, in turn, branch into a list of sub-steps, which we will detail below.

It is worth mentioning the technical peculiarities of implementing this platform, namely: