Rules of publication and recommendations for formatting of articles for the journal "Numerical methods and programming"

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Abstract: The text describes the thematic focus of the journal, criteria for selection of articles for publication, rules of submission of articles for publication, the reviewing procedure, interaction of authors with the editors. It also contains a style sheet with samples, as well as rules of bibliographical descriptions both in Russian and English.

Keywords: numerical methods and programming, journal, publishing rules.

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Правила публикации и рекомендации к оформлению статей в журнале "Вычислительные методы и программирование"

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Аннотация: Приведено описание тематической направленности журнала, критериев отбора контента журнала, порядка направления статей для публикации, процедуры рецензирования, взаимодействия авторов с редакцией. Изложены рекомендации к оформлению статей. Даны примеры оформления списков литературы на русском и английском языках.

Ключевые слова: вычислительные методы и программирование, журнал, правила публикации.

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1. General information.

1.1. Main data. The founder and publisher of the journal is the Research Computing Center of Lomonosov Moscow State University (RCC MSU).

The title of the journal in English: "Numerical Methods and Programming".

The title of the journal in Russian: "Вычислительные методы и программирование".

The transliterated title of the journal: "Vychislitel'nye Metody i Programmirovanie".

The journal has been published since 2000.

Frequency: 4 issues per year (since 2006).

The journal is registered with the Federal Agency for Press and Mass Communications as a mass medium — a scientific electronic periodical (certificate of registration No. 77-4356, ISSN 1726-3522).

The journal is included in the Higher Attestation Commission (Russian Federation) List of leading peer-reviewed scientific journals and publications in which the main scientific results of dissertations for the degree of doctor of science and Ph. D. should be published.

Bibliographic information on published articles is placed in the scientific citation database of the RSCI.

The journal is included in the RSCI bibliographic database on the Web of Science platform, in the core of the Russian Science Citation Index, and in All-Russian Mathematical Portal MathNet.Ru.

Articles published in the journal are assigned doi (since 2015).

1.2. Aims & Scope. The journal publishes works in the following areas and scientific specialties:

1. Methods and algorithms of computational mathematics and their applications for solving scientific and technical problems.

   The publication should contain new results obtained in the field of methods and algorithms for solving problems of computational mathematics, mathematical modeling and computational experiments, test problems and research to determine the applicability of algorithms, parallel software implementation of problems of computational mathematics. Reviews of methods and software are published, containing recommendations for their application.

2. Parallel software and technologies for solving problems of computational mathematics and its scientific and technical applications.

   Articles related to numerical software targeted at supercomputers and parallel architecture computing systems.

   Researches in the field of theory and technology of designing programs of computational mathematics and its scientific and technical applications, as well as their integration into software systems (development of taxonomy and classifications of problems and methods, disciplines and programming techniques, technological processes for compiling numerical programs for computers with parallel architecture, methods for conducting computational experiments, etc.).

   The results of research on the development of tools for automating the design, operation and maintenance of numerical programs and software systems for computers of various architectures (development of problem-oriented languages, means of remote access and organization of interactive modes, data visualization, conversions of numerical programs and display of computational algorithms on computer architecture, means of verification and macro-generation of programs, macro-extensions of algorithmic languages, preprocessors and macro-processors, etc.) are accepted for publication.

1.3. Language of publications. Articles are accepted for publication in Russian and English.

1.4. Publication ethics. Journal "Numerical Methods and Programming" strictly adheres to the international publication ethics standards set by the Committee on Publication Ethics [1].

Authors of publications voluntarily undertake to adhere to the following ethical standards:

1. The authors are responsible for the accuracy of the research results, the content of the article and for the very fact of its publication.

2. Authors should not submit to the journal materials for publications that are under consideration in another journal, as well as articles published in other journals. Authors should be aware that submitting the same article to different publications is a violation of publication ethics.

3. The authors guarantee that they submit to the editorial board of the journal original articles, previously unpublished anywhere, free from plagiarism and scientific falsifications. If the authors use their own

previously published results as a basis for the presented article, then they are obliged to indicate references to these results and specify what new results were obtained in comparison with the previous ones.

4. Authors should refer to works that were important in the study, as well as acknowledge those who have made significant contributions to the work. Borrowed fragments or statements must be made with the obligatory indication of the author and the original source.

5. Authors should not divide a holistic research into several publications in order to increase their number. Significant in terms of volume of work can, in agreement with the editors, be published in several issues of the journal.

6. All co-authors of the manuscript warrant that they have made significant contributions to the research.

7. The authors provide in the article an exhaustive list of sources of financial support for the study and the role of these sources in the study.

8. Authors must adhere to the rules of paper design accepted in the journal.

9. Authors must explicitly agree with the rules for preparing articles for publication, including peer review, scientific and literary editing, and bringing articles to editorial standards accepted within the journal.

10. The authors must express their consent to the transfer to the journal of the right to publish and distribute the article in electronic and paper versions, including the placement of bibliographic information about the article in scientific citation bases, as well as the placement of the full text of the article in the Scientific Electronic Library (elibrary.ru) for free access to all Internet users, regardless of their category and location.

11. If the authors find any inaccuracies in an already published article, then they are obliged to inform the members of the editorial board of the journal and jointly participate in correcting the publication.

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Responsibilities of reviewers:

1. The main task of the reviewer is an objective and prompt assessment of the correspondence of the submitted articles to the subject of the journal, scientific novelty and the level of the presented results, the quality of preparation of materials; formulating recommendations for the publication of materials, their revision or rejection with respect to the due level of confidentiality, following the generally accepted standards of objectivity COPE, ensuring non-disclosure of information and promptly reporting conflicts of interest.

2. The reviewer in his comments and recommendations should provide single-blind peer review without revealing his identity to the author.

3. Any manuscript submitted for review should be considered a confidential document. It is unacceptable to show it to other reviewers or discuss it with other experts without the prior permission of the editor-in-chief.

4. One of the important tasks of the reviewer's activity is the improvement of materials and manuscripts, the publication of which in the journal is of interest to the scientific community and can make a significant contribution to the development of branches of science within the scope of the journal's topics, through comments and suggestions to the authors.

5. The reviewer makes a significant contribution to the activities of the scientific journal. His peer review serves as the basis for editorial decisions to be made by the editorial board.

6. Taking into account the high rhythm of modern scientific life, the publication of significant scientific results should take place as soon as possible. Based on this, the reviewer selected for the evaluation of the work, who believes that the level of his qualifications or the time resources available to him are insufficient for the operational review of the research presented in the scientific work, must notify the editor about this and abandon the review process.

7. Reviews of scientific papers must be objective. The personal criticism of the author by the reviewer is categorically inappropriate. Reviewers are required to express their views clearly, to the point and reasonably.

8. Peer reviewers should identify papers relevant to the research and previously published in peer-reviewed journals that have not been properly cited or cited by the authors.

9. The reviewer is also obliged to draw the attention of the editor to any significant or partial similarity with any other work with which the reviewer is directly familiar.

10. Unpublished materials used in the submitted manuscript should not be used in the reviewer's own research without the written consent of the author.

11. Non-public information obtained during the review must remain confidential and not be used by the reviewer for personal gain.

The editor-in-chief and the editorial board of the journal undertake to follow the generally accepted norms of publishing ethics in relation to the authors of articles sent for publication:

1. The decision to publish is made based on the results of assessing the reliability of the information presented in the article, scientific novelty, clarity of presentation, research and compliance of the work with the subject of the journal. Gender identification, race, citizenship, social status, political views and other attributes of the authors not related to scientific activity cannot serve as a reason for refusal to publish.

2. All articles submitted to the editorial board undergo single-blind peer review. Reviewers must be experts on the subject of the submitted research, they must guarantee an objective assessment of the articles according to the criteria set out in clause 1, in particular, the absence of a conflict of interest, and clearly formulate their conclusions on the submitted articles, including an assessment of the possibility of their publication and recommendations for revision.

3. The editorial board reserve the right to cancel the positive decision to publish the material in the event of serious violations of publication ethics that were missed at the stage of reviewing.

4. The editorial board of the journal ensures the confidentiality of any information about the submitted articles until the moment of their publication. The knowledge gained in the process of editing and reviewing cannot be used for the purpose of obtaining personal gain before the publication of the article.

5. The editorial board does not allow the publication of articles with signs of plagiarism. The presence of borrowing without reference to the source, unofficial citation and paraphrasing, assignment of rights to the results of other people's research are considered plagiarism and are sufficient grounds for rejection of the article.

6. The editorial board takes measures to identify and prevent the publication of articles reflecting research in the course of which there were violations of the law; including, for this purpose, information about such offenses received from external sources is carefully considered.

7. The editorial board of the journal has the right to withdraw an already published article and, if appropriate, return it to the authors for revision, if the publication of the article entailed a violation of someone's rights or generally accepted norms of scientific ethics.

8. The editors are ready to publish corrections, explanations, refutations and apologies related to previously published articles, including in case of receipt of relevant requests from the authors.

9. In case of revealing violations of publication ethics on the part of the authors, the editors ask the authors for clarifications; in case of an unsatisfactory answer, the editorial board has the right to contact the employer of the authors or the competent executive authorities.

10. The editorial board does not leave unanswered the authors' comments regarding both their published works and those accepted for publication.

11. The editorial board of the journal adheres to the established terms of publication if the authors fulfill the necessary requirements for articles.

12. The editor-in-chief may apply to the Association of Scientific Editors and Publishers (ASEP) to resolve ethical disputes between the editorial board and the authors of the articles.

13. The editorial board of the journal is not responsible for any damage caused by the publication of the article.

1.5. Publication fee. For authors, the publication of articles is free.

1.6. Copyright for the publisher. To protect the rights and interests of both parties, the Research Computing Center of Lomonosov Moscow State University (RCC MSU), an exclusive license is required, which clearly defines our rights and special rights reserved by the authors. We ask each author to provide the RCC MSU with this exclusive license after the article has passed the reviewing stage and a decision has been made to publish the article in our journal.

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1.9. Long-term deep archiving and digital preservation policy. All issues of the journal "Numerical Methods and Programming" are uploaded article by article to the scientific electronic library https://elibrary.ru and to the portal for searching scientific information on mathematics, physics, information technology and related sciences http://mathnet.ru.

Additionally printed obligatory copies of each issue are also transferred to the Russian Book Chamber (Legal Deposit).

2. Recommendations for the content and structure of articles.

2.1. Publication forms. The editorial board of the journal accepts for consideration the author's materials, drawn up in the form of a review or an original article.

Reviews can cover any modern achievements related to the subject of the journal. Reviews should be written in such a way as to assist the reader in assessing emerging prospects and opportunities, as well as in finding publications containing key information about new developments. In the introductory part of the review, it is desirable to provide an explanation of the main tasks, concepts and terms. The reader of the review article should understand the need for an in-depth study of the problem using the bibliographic references provided for the article, so the review should not look like a listing of innovations and references to sources.

Original articles must correspond to the subject of the journal. The novelty and scientific significance of the work are checked by reviewers and the editor-in-chief. The information in the original article must be complete, allowing a specialist in this field to reproduce the results obtained by the authors. It is not recommended to

present generally known information in the original articles. When submitting manuscripts, the authors are fully responsible for the fact that the presented research results are performed personally, comply with the norms of scientific ethics and are carried out on an open topic.

2.2. Volumes of published materials. Review articles can be up to 30 pages per issue. The publication of reviews in several issues takes place in agreement with the editor-in-chief. Authors of original articles are recommended to be up to 20 pages long.

2.3. Article title. Authors should give the article the most specific and informative title, if possible, not exceeding 20 words.

2.4. Annotations. Review and original articles should be accompanied by annotations giving an idea of the essence and novelty of the published results. The abstract should be understandable before reading the article and should not contain links to any publications. The volume of the annotation should not exceed 10-15 lines. It is not recommended to break annotations into paragraphs.

2.5. UDC codes. The authors of the article indicate the UDC (only for articles in Russian), which the publication corresponds to.

2.6. Keywords. Authors should indicate the set of keywords that best characterize the published research results. Keywords are used to automatically search for an article, for example in an electronic library. We recommend that authors choose no more than 10 keywords or phrases for their article.

2.7. Acknowledgments. Authors can express their gratitude to persons who have provided significant assistance in the work, or indicate sponsorship and grants.

2.8. Structure of Articles. Depending on the size of the article, the text of the article can be structured into sections (\section) and subsections (\subsection) (like this article) or only into sections.

It is not recommended to give titles of sections and subsections that would span more than two lines.

Subsections can consist of two or more paragraphs[1]. It is recommended for better perception to break the text into paragraphs no more than 10–15 lines in size.

2.9. Bibliography. The list of references is an integral part of the article and is drawn up directly in the text of the article with the indication doi, if the publication is assigned a digital identifier. The list of references is formed in the order of reference to the sources in the text of the article.

A mandatory requirement is a complete translation of the bibliography into English for indexing an article in foreign databases.

The use of separate files with the bib, bbl and others extensions is not allowed.

2.10. Translation. Authors of articles published in the journal in English must provide translated into Russian:

- surname, name, patronymic, academic degree, academic title of each author;
- the name, postal addresses of the organizations that are the main places of work of the authors, and their positions in these organizations;
- article title;
- annotation text;
- keywords;
- acknowledgments.

If the translation into Russian of this information by the author is difficult, the editors should be notified of that situation so that this work can be done by them.

3. Requirements for the design of articles.

3.1. Preparation of the article. The editors accept articles from authors prepared in the LaTeX publishing system [2–4].

Authors of articles can use additional style files, for example algorithmx for a set of algorithms, etc. Additional style files must be explicitly included in the document preamble. Using your own styles is not recommended.

Articles prepared using Microsoft Word or other editors are accepted only in exceptional cases by the decision of the editors and will be published with a delay due to the translation of the original text into the LaTeX publishing system and additional editorial revisions.

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[1]These "Guidelines" is not a typical article, therefore it cannot serve as a guide in this matter.

3.2. Typing requirements. We draw the attention of the authors to the following typing rules:

1. There should always be a space between the initials and the surname (A.A. Ivanov). In the title of the article, spaces are also placed between the initials: A. A. Ivanov.

2. The integer part of the number should be separated from the fractional part in the same way in the text of the article: either a comma or a period. On graphs and diagrams formed as a result of the work of programs, and in program listings, the integer part of the number from the fractional part can be separated by a dot.

3. The quotation marks should be in the form of "legs".

4. Dates must be typed in the format dd.mm.yyyy.

5. The period is not put after the section headings, table titles and figure captions, after a number of abbreviated names: s — second, g — gram, min — minute, d — day, mil — million, bil — billion, etc. The period is placed at the end of the last sentence of the annotation, after the abbreviations: mon. — month, etc.

6. Multi-word abbreviations are separated by spaces, for example 760 mmHg. Art., with the exception of commonly used ones (i.e.).

7. Quotes and brackets are not separated by spaces from the words enclosed in them: (for $U_{\max}$), (a); and not (at $U_{\max}$), (a).

8. A non-breaking space is placed between the number or paragraph sign and the number: No. 1, § 5.65.

3.3. Requirements for a set of formulas, theorems, etc..

1. Needs to be typed in straight type: a) all numbers are typed in straight type in formulas; b) abbreviations of words, including in indices (for example, E_{ion} — ionization energy); c) abbreviations of mathematical functions: sin, cos, lim, max.

2. For typing excluded formulas, it is recommended to use the `equation` environment with automatic continuous numbering. To suppress numbering, use the `equation*` environment.

3. The style file provides for the placement of summation indices, integration limits, etc. strictly above or below mathematical symbols:

$$\sum_{n=0}^{+\infty} = \dots \ , \qquad \int\limits_{0}^{\pi} \sin^2(x)dx = \dots \ . \tag{1}$$

4. Formulas that span one or more lines (so-called exclusion formulas) and are part of a sentence must obey the rules of punctuation.

5. Vectors must be typed using the `\bm{}` (bold italic) command, not `\vec{}`.

6. Matrices should be typed in normal mathematical font, for example, matrix A and transposed A^T.

7. The words "Theorem", "Collorary", "Lemma", "Asserrtion", "Proposition" are placed in the text of the article explicitly and are highlighted in bold, and the corresponding formulations are in italic font.

8. The words "Proof", "Definition", "Remark" are in roman italic style, and the corresponding wording is in roman type.

9. It is recommended to carry out continuous numbering with Arabic numerals for theorems, definitions, etc.

3.4. Requirements for a set of listings of programs and algorithms. It is allowed to reproduce small in volume (no more than 1 page is recommended) fragments of programs illustrating important algorithms, programming language tools, etc. Text messages and comments in listings must be in English. Examples of listing programs and algorithms are given in Appendix 1.

3.5. Requirements for illustrations.

1. The editors make minimal edits to the illustrations. In case of insufficient quality illustrations, the article is sent back to the authors for revision.

2. The following dimensions of illustrations are recommended: a) no more than 165 mm wide and no more than 210 mm high (in the width of a text column); b) no more than 80 mm wide and no more than 140 mm high (half the column width); c) 145 mm high and 240 mm wide (illustration expanded 90° on the whole page).

3. Three types of illustrations are accepted: line drawings (graphs, diagrams, graphs, etc.), screenshots of the computer screen (for example, color visualization of the field obtained as a result of mathematical modeling) and photographs.

4. Line drawings is accepted in the form of PNG (raster) files with a resolution of 600 DPI at a 1:1 scale of the figure or in EPS format (vector images). The thickness of the thinnest line in the picture should not be less than 5 px. It is recommended to use black for the main lines. Elements of the picture that are important for understanding should be highlighted in two or three colors, which are contrastingly reproduced in black and white printing. Recommended background color is white.

5. Photos are accepted in formats JPEG, PNG, TIFF with a resolution of 300 DPI. The image in the photo should be sharp, contrasting. Digital image processing should not raise doubts about the authenticity of the photograph.

6. Figures must be in English. It is recommended to designate important elements of the figure with numbers and give a decryption in the signature.

7. The series of illustrations is intended for comparing graphs, assessing the influence of parameters, explaining trends, dynamics, etc. Illustrations included in the series must be of the same size and resolution. Each illustration in the series must be designated with a letter of the English alphabet. Examples of illustrations design are given in Appendix 2.

8. The editors draw your attention to the fact that the preliminary layout made by the authors often leads to a deterioration in the quality of the pictures, for example, due to the incorrectly set resolution when converting a picture to EPS format. The editors ask to provide, along with EPS files, the original "raw" files in the formats TIFF, PNG, JPEG without processing. If the picture is a screenshot from the computer screen, then it must be taken at the maximum window size and no longer scaled. Authors can make a copy of the figure in the format and sizes they need and insert it into the text of the article.

3.6. Requirements for the design of tables. The editors recommend formatting tabular data using the LaTeX publishing system (Appendix 3). Text in table cells must be in English. Highlighting table cells with color unnecessarily is not encouraged.

The exception is tables obtained from the Internet or automated data processing systems in the form of screenshots.

3.7. Requirements for captions of figures and titles of tables and listings.

1. Figures, tables, formulas, program listings, etc. must have consecutive numbering for each type of structural elements of the article. Examples of registration of captions for figures, tables and listings are given in Appendices 1–3.

2. Signatures should be informative and concise. It is recommended that signatures be worded so that they do not span more than three lines.

3. The caption to a series of illustrations must contain a common name for all figures in the series and a list of captions specifying each illustration (Appendix 2, Fig. 2).

3.8. Requirements for References.

1. The list of references is formed in the order of reference to the sources in the text of the article.

2. Articles published in Internet publications must be provided with an up-to-date link.

3. The preferable version of the link is to indicate the doi of the publication.

An example of the References format is given in Appendix 4.

3.9. References to figures, formulas, tables, sources. The editors do not recommend using manually typed links in the text of the article. To reduce the likelihood of errors in links in the text of the article, it is necessary to use the commands \label, which automatically stores the values of counters for figures, tables, lists in a symbolic variable, and \ref, which creates a link by the name of the variable [2, 4].

4. Interaction with the editors.

4.1. Required documents. To publish an article, authors must provide:

1) a cover letter of the authors (Appendix 5 in this document) in electronic form and its scanned version with "live" signatures;

2) electronic LaTeX-version of the article in English, prepared in accordance with the requirements documents for the design of articles, as well as a pdf-file of the article and pictures;

3) a text file containing the following information in Russian and English: a) surname, name, patronymic, academic degree, academic title, ORCID and e-mail of each of the authors; b) the names and postal addresses of organizations that are the main places of work of the authors and their positions in these organizations; c) the title of the article; d) annotation text; e) keywords.

4.2. Transfer of documents to the editorial office. The author interacts with the editors mainly through the journal's website https://num-meth.ru. After completing the registration form, the author (one of the authors) have to:

1) download through the form all the prepared necessary documents and article components in the form of a ZIP-archive, choosing when downloading the `Article Component` = ''ZIP-archive with source texts (`.tex` and required additional files)'';

2) give a description of the archive, authorship, etc. (it is recommended to do it at the stage of checking the details of the sent file);

3) confirm sending the archive;

4) enter article metadata (title, abstract and keywords required) and information about the author and all co-authors (all information must be entered in Russian and / or in English);

5) confirm the entered data.

The author receives e-mail notifications for all significant events accompanying the process of preparing an article for publication. The author should monitor the change in the status of the article and, if necessary, respond to the editorial board's invitations to enter into a dialogue on the pages with the discussion of the material (for example, when communicating with a literary editor).

4.3. Publication decision, peer review procedure.

1. The editors consider articles only relevant to the subject of the journal. If the article is rejected, the editorial board notifies the author of the decision and does not enter into a discussion with the author of the correspondence of his article to the subject of the journal. The author has the right to publish his work in another edition.

2. An article accepted by the editorial board for review after preliminary selection undergoes a *single-blind peer review* procedure approved by the journal.

3. The author receives a review of his article and a notification from the editor-in-chief about the acceptance of the article for publication, about the need for revision or rejection of the article, indicating the reasons.

4.4. Preparing an article for publication. The article accepted for publication goes through the stages of literary and technical editing. Depending on the quality of the materials presented, the author will be in more or less intensive correspondence with the editors. Authors are encouraged to respond to letters from editors within one to two days so that the publication takes place in the intended issue of the journal.

4.5. Publishing an article. Articles from the typeset issue of the magazine are posted on the website, the issue is sent to print. The author is notified of the publication.

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Appendix 1
Registration of listings of programs and algorithms

Listing 1. A C/C++ program that takes up the full width of the typing strip. We draw the attention of the authors to the following feature of the \begin{lstlisting}...\end{lstlisting} environment: square brackets [ ] are used to specify a parameter block, and a comma is used to separate parameters. The listing title in English is typed as follows:

```
caption={An example of the design of a program fragment
         (with the permission of the author \mbox{[\ref{rfa:enlit:Antonov}]})},
```

External curly braces in `caption={...}` allow you to use a comma in the caption text, if necessary, and the `\mbox{[\ref{rfa:enlit:Antonov}]}` construct escapes the square brackets [ ], allowing you to use them in the link to reference.

Listing 1. An example of the design of a program fragment (with the permission of the author [6])

```c
// OpenMP technology
// applying the single directive with the nowait option
#include <stdio.h>

int main (int argc, char *argv[])
{
#pragma omp parallel
{
     printf("Message␣1\n");
#pragma omp single nowait
     {
          printf("One␣thread\n");
     }
     printf("Message␣2\n");
}
}
```

Listing 2. Fortran program. The `float` parameter may be useful for authors, which determines the placement of the listing as a floating object on the page: `t` and `t!` set the placement at the top of the page, `b` and `b!` — at the bottom, and `h` and `h!` — in the place of the text where the listing is located. Using parameters with an exclamation mark `t!`, `b!` and `h!` ensures that the listing is placed on the closest possible page.

Algorithm 1. An example of the design of the algorithm. The packages algorithm, algpseudocode, etc., existing in LaTeX 2$_\varepsilon$, contain various commands and environments that give the algorithms the look accepted in scientific literature. The commands in these packages define the representation of algorithmic operations: for example, the command `x\gets 10` is displayed as $x \leftarrow 10$ and means that the variable x is assigned the value 10.

Often, the authors of our journal, due to the lack of a national standard in this area, use the original designations of algorithmic operations, therefore the editors recommend using the commands defined in the

Listing 2. Undistributed parallel loop in FDVMH language (floating object)

```fortran
!DVM$ REGION TARGETS(HOST) OUT(A)
!DVM$ PARALLEL(I,J,K) TIE (A(K,J,I))
  DO I = Li, Hi
    DO J = Lj, Hj
      DO K = Lk, Hk
        A(K,J,I) = ....
!DVM$ END REGION
```

style file of the journal for a set of algorithms. Unlike the packages algorithm, algpseudocode and some others, our style file defines commands that are responsible for placing algorithmic operations, but not for representing them.

Let's consider the main commands that were used in the set of Algorithm 1. Environment

```
\begin{nmAlgorithm}{<symbolic label>}{<English title>}
...
\end{nmAlgorithm}
```

marks the area for the algorithm. The command

```
\algLine[<number of indents>][<symbolic label>]{<algorithmic operation>}
```

is used to form an algorithm line. The `<number of indents>` and `<symbolic label>` parameters are optional for the `\algLine` command.

For convenience, the style file defines commands for frequently used algorithmic operations and constructions: `\algINPUT` — prints **input**; `\algFOR` — **for**; `\algDO` — **do**; `\algENDFOR` — **end for**; `\algIF` — **if**; `\algTHEN` — **then**; `\algELSE` — **else**; `\algELIF` — **elseif**; `\algENDIF` — **end if**; `\algOUTPUT` — **output**; `\algSTOP` — **stop**; `\algFUNC` — **function**; `\algENDFUNC` — **end function**. The definition of these commands is primitive:

$$\newcommand{\algELSE}{\textbf{else\ }},$$

and their set can be extended by the author of the article himself, if necessary.

The `\newcommand{\algGOTO[1]{\textbf{goto}~\ref*{#1}}}` command defined in the style file takes the symbolic label specified in the `\algLine` command as an argument and generates the text **goto** `<line number containing the label>`.

Algorithm 1. Function g (calculating the coordinates of the point v by its ordinal k)

1:   **function** $g(k, d, p)$
2:       $u_{n-1} := \lfloor k/(d-1)^{n-2} \rfloor$
3:       $u_n := u_{n-1}$
4:       $k := k \mod (d-1)^{n-2}$
5:       **for** $j = (n-3)\ldots 0$ **do**
6:           $u_j := \lfloor k/(d-1)^j \rfloor + 1$
7:           $k := k \mod (d-1)^j$
8:       **end for**
9:       **return** $(v_1, \ldots, v_n)$
10:   **end function**

Algorithm 2. Comparison of two variants of the algorithm. To make it convenient for the reader to compare variants of an algorithm or to show the difference between two similar algorithms, the author needs to place them line by line next to each other (see Algorithm 2).

For a set of algorithms that require matching, you need to use the command

```
\algLineDouble[<number of indents>][<symbolic label>]
           {<algorithmic operation, algorithm 1>}{<algorithmic operation, algorithm 2>},
```

which arranges lines of algorithms in two columns.

Algorithm 2. Generating validation set points (parameters d, ρ)

---

a) with dublicates	b) no dublicates
1: $\varphi := \pi/d$	1: $\varphi := \pi/d$
2: **for** $j_{n-1} = 0\ldots(2d-1)$ **do**	2: **for** $j_{n-1} = 0\ldots(2d-1)$ **do**
3: $\theta := j_{n-1}\varphi$	3: $\theta := j_{n-1}\varphi$
4: **for** $j_{n-2} = 0\ldots d$ **do**	4: **for** $j_{n-2} = 1\ldots d-1$ **do**
5: $\phi_{n-2} := j_{n-2}\varphi$	5: $\phi_{n-2} := j_{n-2}\varphi$
6: $\ldots$	6: $\ldots$

7:	**for** $j_2 = 0 \dots d$ **do**	
8:	$\phi_2 := j_1 \varphi$	
9:	**for** $j_1 = 0 \dots d$ **do**	
10:	$\phi_1 := j_1 \varphi$	
11:	$\varpi := 1$	
12:	$v_1 := \rho \cos(\phi_1)$	
13:	**for** $l = 2 \dots n - 2$ **do**	
14:	$\varpi := \sin(\phi_{l-1})\varpi$	
15:	$v_l := \rho \cos(\phi_l)\varpi$	
16:	**end for**	
17:	$v_{n-1} := \rho \sin(\theta)\varpi$	
18:	$v_n := \rho \cos(\theta)\varpi$	
19:	**output** v	
20:	**end for**	
21:	**end for**	
22:	$\dots$	
23:	**end for**	
24:	**end for**	
25:	**stop**	

Second column:

7:	**for** $j_2 = 1 \dots d - 1$ **do**
8:	$\phi_2 := j_1 \varphi$
9:	**for** $j_1 = 1 \dots d - 1$ **do**
10:	$\phi_1 := j_1 \varphi$
11:	$\varpi := 1$
12:	$v_1 := \rho \cos(\phi_1)$
13:	**for** $l = 2 \dots n - 2$ **do**
14:	$\varpi := \sin(\phi_{l-1})\varpi$
15:	$v_l := \rho \cos(\phi_l)\varpi$
16:	**end for**
17:	$v_{n-1} := \rho \sin(\theta)\varpi$
18:	$v_n := \rho \cos(\theta)\varpi$
19:	**output** v
20:	**end for**
21:	**end for**
22:	$\dots$
23:	**end for**
24:	**end for**
25:	**stop**

Algorithm 3. An example of combining the text of the article and the algorithm. Below is an example of the design of a small algorithm next to the text of the article. For this, the environment is used

```
\begin{wrapfigure}{r}{80mm}
    ...
\end{wrapfigure}.
```

In steps 11–18, spherical coordinates are converted to Cartesian coordinates using formulas (2). Using variable bounds in the headers of the loops in steps $2, 4, \dots,$ 7, 9, it is easy to calculate that Algorithm 1a generates $2d(d + 1)^{n-2}$ points. The disadvantage of Algorithm 1a is that it generates some points with repetitions. The performed computational experiment showed that for dimension $n = 4$ and the number of parallels $d = 5$, Algorithm 1a generates 189 duplicates with a total number of points equal to 360, which is more than 50%. Duplicates are generated in iterations when $\phi_i = 0$ or $\phi_i = \pi$, which corresponds to the values $j_i = 0$ and $j_i = d$ $(i = 1, \dots, n - 2)$. This is due to the fact that in this case one of the factors $\sin(\phi_i)$ in (2) will be equal to zero and, therefore, variations of other factors will no longer be able to change the value of the corresponding coordinate. The solution to the problem of duplicates without major reworking of Algorithm 1a is achieved by changing the lower and upper bounds of the variables in the headers. . .

Algorithm 3. Validation of the solution $\widetilde{x}$ to the LP problem

1:	**input** $n, A, b, c, d, \rho, \varepsilon, \widetilde{x}$
2:	$\varphi := \pi/d$
3:	**for** $k = 0 \dots 2d(d - 1)^{n-2} - 1$ **do**
4:	$v := g(k, d, \rho)$
5:	$Av \leqslant b$ & $\langle c, v \rangle > \langle c, \widetilde{x} \rangle + \varepsilon$ **goto** 9
6:	**end for**
7:	**output** "Solution is correct"
8:	**goto** 10
9:	**output** "Solution is incorrect"
10:	**stop**

Appendix 2
Design of illustrations

Figure 1. Inserting a picture that takes up half the typesetting width into text. It is recommended to "wrap around" the pictures, the width of which does not exceed 80 mm. This requires use the environment

```
\begin{wrapfigure}{r}{<linear size>}
    ...
\end{wrapfigure}.
```

The required parameter `{r|l}` specifies the position of the picture at the right or left edges of the text. Linear size can be specified both in absolute units, for example `{80mm}`, and in relative units — `{0.5\linewidth}`.

Let a linear programming problem be given in the Euclidean space $\mathbb{R}^n$

$$\bar{x} = \arg\max\left\{\langle c, x\rangle \mid Ax \leqslant b, x \in \mathbb{R}^n\right\}, \quad (1)$$

where c is the vector of the objective function coefficients. Here and below, $\langle\cdot,\cdot\rangle$ denotes the scalar product of two vectors. We set $M = \{x \in \mathbb{R}^n \mid Ax \leqslant b\}$ is the set of feasible points of problem (1). By definition, the set M is convex. Throughout what follows, we will assume that M is a non-empty, bounded (and, therefore, closed) set, that is, problem (1) has at least one solution. Let $\tilde{x} \in \mathbb{R}^n$ be an approximate solution to problem (1) obtained using some LP-solver and requiring certification.

The idea of the VaLiPro validation method described in this work is to construct a finite set of points V covering a hypersphere S of small (compared to the size of the polyhedron M) radius ρ centered at the point of the being certified solution $\tilde{x}$:

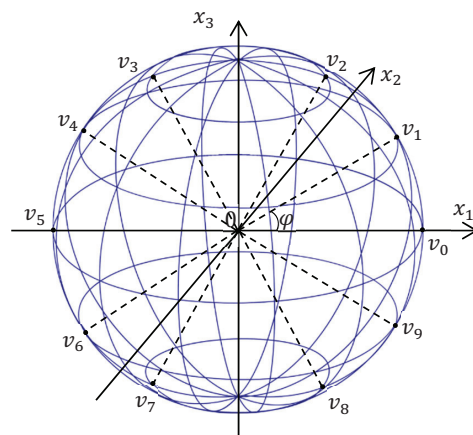$$V \subset S = \left\{x \in \mathbb{R}^n \mid \|x - \tilde{x}\|^2 = \rho^2\right\}.$$

Figure 1. Construction of points of the validation set V on the three-dimensional sphere for $d = 5$

Figure 2. Inserting a series of figures. We draw the attention of the authors to the problem of integrating formulas and fonts of the publishing system LaTeX 2_ε into figures created in graphic editors or in any other way. In the overwhelming majority of cases, authors try to place on their drawings formulas and inscriptions that look unnatural due to the fact that they were typed in fonts that are not included in the LaTeX 2_ε publishing system.

Let's consider the most common case of inserting a series of figures into the text. We assume that the author has chosen the optimal size of the pictures and there are no inscriptions on the pictures.

1. Creates a floating object using the environment

```
\begin{figure}{t!}
    ...
\end{figure}.
```

Mandatory parameters `{t}` and `{t!}` specify the placement at the top of the page, `{b}` and `{b!}` — at the bottom, and `{h}` and `{h!}` — where the floating object is located.
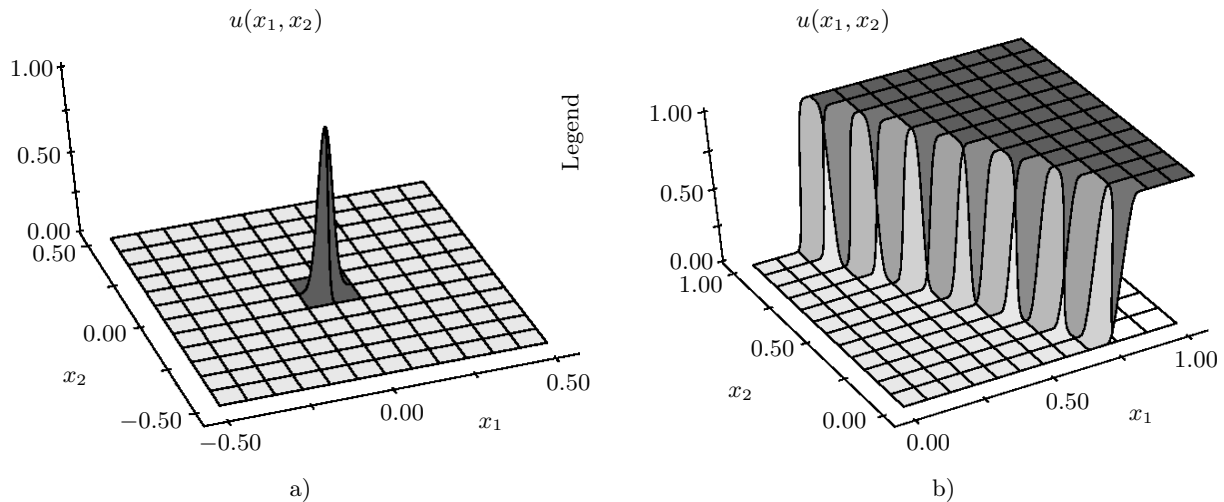
Figure 2. Exact solution: a) in example 1.1 at $\beta = 1000$; b) in example 1.2 at $\beta = 10^{-4}$

1   2. Inside the floating object create an environment `{picture}`

2 `\begin{figure}{t!}`

3   `\begin{picture}(170,65)`

4   `...`

5   `\end{picture}`

6 `\end{figure}`.

7 The size of the area reserved for drawings is indicated in parentheses in millimeters. In this example, the area

8 is 170 mm wide and 65 mm high. Note that the size of the drawings themselves slightly less than 65 mm in

9 height.

10   3. Using the command `\put(<x-координата>, <y-координата>){<объект>}`, both the figures them-

11 selves and any inscriptions are placed in the desired place in the reserved area.

12   For example, the command

13   `\put(11.3,7.5){\includegraphics[width=70mm]{./pic/Bel_sol1r.eps}}`

14 loads the `Bel_sol1r.eps` picture from the `./pic/`, directory, proportionally scales it to a width of 70 mm and

15 places it inside the area reserved in the `{picture}` environment so that the coordinates of the lower left corner

16 of the picture become 11.3 mm along the horizontal axis and 7.5 mm along the vertical axis.

17   The `\put(35,62){$u(x_1, x_2)$}` command displays the inscription $u(x_1, x_2)$ over the picture.

18   The `\put(x,y)` command can take the `{picture}` environment as an output object:

19   `\put(x0,y0){\begin{picture}(0,0) ... \end{picture}}`.

20 Such use of nested environments `{picture}` makes sense if the coordinates of the second picture and inscriptions

21 on it differ from the coordinates of the first picture by the vector $(x0, y0)$. The size of the area reserved by the

22 `{picture}` nested environment is immaterial and can be `(0,0)`.

23   The following commands display inscriptions over the image:

24 `\put(75,43){\rotatebox{90}{Legend}}`

25   4. After the `{picture}` environment, place captions to figures using the `\caption`:

26 `\begin{figure}{t!}`

27   `\begin{picture}(170,60)`

28   `...`

29   `\end{picture}`

30   `\caption{<signature text>}`

31 `\end{figure}`.

Appendix 3
Design of tables

Table 1. Inserting text in two languages into table cells. Presentation of information in tabular form is often used in the design of articles. In simple cases, it is enough to use the well-known {array} and {tabular} environments [2, 4]. The {tabularx} [2, 3] environment and the \makecell [7] command are more convenient to use.

Consider the key points in the design of the Table 1. The table header is formed by the \caption command. Table 1, there are ten columns, but the number of columns in the first row of the table is reduced to four by combining three columns into one command \multicolumn{3}{c|}{}. The table is set by the {tabularx} environment with parameters:

```
\begin{tabularx}{170mm}{|>{\centering\arraybackslash}X|
        *{3}{>{\centering\arraybackslash}p{11mm}|}
        *{3}{>{\centering\arraybackslash}p{14mm}|}
        *{3}{>{\centering\arraybackslash}p{11mm}|}},
```

where the table width is set equal to the width of the stripe ({170mm}), the first column has an undefined width (X), due to which the entire table is justified in width during compilation, the width of the remaining columns is set explicitly in the corresponding specifiers.

To place text on two lines inside a cell, we recommend using the \makecell{} command, in which the \\ command saves its line breaking function. Horizontal snapping is specified in the \makecell[]{} command using an optional argument in square brackets: [t] — snapping to the top line, [b] — to the bottom line, [c] — to the center of the block.

Table 1. Times in seconds of Fortran programs, NPB 3.3 class D

	MPI programs			Converted MPI programs			MPI programs + **FDVMH**		
	BT	CG	EP	BT	CG	EP	BT	CG	EP
1 node	665.1	397.5	93.68	785.29	376.8	83.34	63.3	80.99	0.62
2 nodes	361.6	209.6	46.53	428.07	229.61	42.06	50.3	42.6	0.38
4 nodes	196.8	91.3	23.3	232.36	96.67	25.16	45.5	34.3	0.17

Table 2. Combining several vertically spaced cells into one. The following table shows the use of the command

```
\multirow[<vpos>]{<rows>}[<bigstruts>]{<width>}[<vmove>]{<text>}.
```

The example uses only the required arguments {<rows>}, {<width>}, and {<text>} [8].

Table 2. Results of numerical experiments in example 1.1

K	$N \times N$	FDM		LSC method		FDM		LSC method	
		$\|E_a\|_\infty$	R	$\|E_a\|_\infty$	R	$\|E_a\|_\infty$	R	$\|E_a\|_\infty$	R
		$\beta = 100$				$\beta = 1000$			
2	10×10	$3.843 \cdot 10^{-1}$	—	$2.92 \cdot 10^{-1}$	—	19.978	—	2.23	—
	20×20	$6.771 \cdot 10^{-2}$	2.50	$5.85 \cdot 10^{-2}$	2.31	3.11	2.68	$7.74 \cdot 10^{-1}$	1.52
	40×40	$1.591 \cdot 10^{-2}$	2.09	$1.38 \cdot 10^{-2}$	2.08	$1.959 \cdot 10^{-1}$	3.99	$1.64 \cdot 10^{-1}$	2.23
	80×80	$3.921 \cdot 10^{-3}$	2.02	$3.45 \cdot 10^{-3}$	2.00	$4.104 \cdot 10^{-2}$	2.25	$3.55 \cdot 10^{-2}$	2.20
6	10×10	$4.942 \cdot 10^{-3}$	—	$7.11 \cdot 10^{-4}$	—	7.985	—	$2.46 \cdot 10^{-1}$	—
	20×20	$3.594 \cdot 10^{-5}$	7.10	$7.30 \cdot 10^{-6}$	6.60	$1.13 \cdot 10^{-1}$	6.14	$1.71 \cdot 10^{-2}$	3.84
	40×40	$4.635 \cdot 10^{-7}$	6.28	$8.65 \cdot 10^{-8}$	6.39	$7.624 \cdot 10^{-4}$	7.21	$1.44 \cdot 10^{-4}$	6.89
	80×80	$7.110 \cdot 10^{-9}$	6.03	$1.23 \cdot 10^{-9}$	6.13	$8.193 \cdot 10^{-6}$	6.54	$1.61 \cdot 10^{-6}$	6.48

Appendix 4
Design of References

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To the chief editor of the scientific journal
"Numerical Methods and Programming"
Corresponding Member RAS,
prof. Vl. V. Voevodin

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