

Resilienz und Fehlertoleranz in verteilten Systemen

MAKSYM DERHACHOV*, FLORIAN SCHMIDT*, and LUKAS ELIAS WESTHOLT*, Hochschule für Technik, Wirtschaft und Kultur Leipzig (HTWK Leipzig), Deutschland

A clear and well-documented \LaTeX document is presented as an article formatted for publication by ACM in a conference proceedings or journal publication. Based on the “acmart” document class, this article presents and explains many of the common variations, as well as many of the formatting elements an author may use in the preparation of the documentation of their work.

1 EINLEITUNG UND MOTIVATION

(Beschreibung von Kontext, Problemen, Anforderungen und Zielen)

ACM’s consolidated article template, introduced in 2017, provides a consistent \LaTeX style for use across ACM publications, and incorporates accessibility and metadata-extraction functionality necessary for future Digital Library endeavors. Numerous ACM and SIG-specific \LaTeX templates have been examined, and their unique features incorporated into this single new template.

If you are new to publishing with ACM, this document is a valuable guide to the process of preparing your work for publication. If you have published with ACM before, this document provides insight and instruction into more recent changes to the article template.

The “acmart” document class can be used to prepare articles for any ACM publication — conference or journal, and for any stage of publication, from review to final “camera-ready” copy, to the author’s own version, with *very* few changes to the source.

(kurze Zusammenfassung der Struktur der Belegarbeit)

Diese Arbeit ist folgendermaßen strukturiert. In Kapitel Abschließend ...

2 GRUNDLAGEN

(Begriffe und Definitionen)

As noted in the introduction, the “acmart” document class can be used to prepare many different kinds of documentation — a dual-anonymous initial submission of a full-length technical paper, a two-page SIGGRAPH Emerging Technologies abstract, a “camera-ready” journal article, a SIGCHI Extended Abstract, and more — all by selecting the appropriate *template style* and *template parameters*.

This document will explain the major features of the document class. For further information, the *\LaTeX User’s Guide* is available from <https://www.acm.org/publications/proceedings-template>.

2.1 Template Styles

The primary parameter given to the “acmart” document class is the *template style* which corresponds to the kind of publication or SIG publishing the work. This parameter is enclosed in square brackets and is a part of the documentclass command:

```
\documentclass[STYLE]{acmart}
```

* Alle Studierenden trugen zu gleichen Teilen zu dieser Arbeit bei.

Diese Arbeit wurde im Rahmen des Mastermoduls „Software Engineering“ (Dozent: Prof. Dr. Andreas Both) an der HTWK Leipzig im Wintersemester 2024/2025 erstellt. Diese Arbeit ist unter der Lizenz ... freigegeben.

Journals use one of three template styles. All but three ACM journals use the acmsmall template style:

- acmsmall: The default journal template style.
- acmlarge: Used by JOCCH and TAP.
- acmtog: Used by TOG.

The majority of conference proceedings documentation will use the acmconf template style.

- acmconf: The default proceedings template style.
- sigchi: Used for SIGCHI conference articles.
- sigchi-a: Used for SIGCHI “Extended Abstract” articles.
- sigplan: Used for SIGPLAN conference articles.

2.2 Template Parameters

In addition to specifying the *template style* to be used in formatting your work, there are a number of *template parameters* which modify some part of the applied template style. A complete list of these parameters can be found in the *\LaTeX User’s Guide*.

Frequently-used parameters, or combinations of parameters, include:

- anonymous, review: Suitable for a “dual-anonymous” conference submission. Anonymizes the work and includes line numbers. Use with the \acmSubmissionID command to print the submission’s unique ID on each page of the work.
- authorversion: Produces a version of the work suitable for posting by the author.
- screen: Produces colored hyperlinks.

This document uses the following string as the first command in the source file:

```
\documentclass[acmtog]{acmart}
```

3 (HAUPTTEIL MIT GGF. MEHREREN SECTIONS)

(der Hauptteil umfasst typischerweise ca. 2/3 bis 3/4 des Texts der Arbeit.)

Modifying the template — including but not limited to: adjusting margins, typeface sizes, line spacing, paragraph and list definitions, and the use of the \vspace command to manually adjust the vertical spacing between elements of your work — is not allowed.

Your document will be returned to you for revision if modifications are discovered.

The “acmart” document class requires the use of the “Libertine” typeface family. Your \TeX installation should include this set of packages. Please do not substitute other typefaces. The “lmodern” and “ltimes” packages should not be used, as they will override the built-in typeface families.

The “acmart” document class includes the “booktabs” package — <https://ctan.org/pkg/booktabs> — for preparing high-quality tables.

Table captions are placed *above* the table.

Because tables cannot be split across pages, the best placement for them is typically the top of the page nearest their initial cite. To

Tabelle 1. Frequency of Special Characters

Non-English or Math	Frequency	Comments
Ø	1 in 1,000	For Swedish names
π	1 in 5	Common in math
\$	4 in 5	Used in business
Ψ_1^2	1 in 40,000	Unexplained usage

ensure this proper “floating” placement of tables, use the environment **table** to enclose the table’s contents and the table caption. The contents of the table itself must go in the **tabular** environment, to be aligned properly in rows and columns, with the desired horizontal and vertical rules. Again, detailed instructions on **tabular** material are found in the *LaTeX User’s Guide*.

Immediately following this sentence is the point at which Table 1 is included in the input file; compare the placement of the table here with the table in the printed output of this document.

To set a wider table, which takes up the whole width of the page’s live area, use the environment **table*** to enclose the table’s contents and the table caption. As with a single-column table, this wide table will “float” to a location deemed more desirable. Immediately following this sentence is the point at which Table 2 is included in the input file; again, it is instructive to compare the placement of the table here with the table in the printed output of this document.

Always use `midrule` to separate table header rows from data rows, and use it only for this purpose. This enables assistive technologies to recognise table headers and support their users in navigating tables more easily.

3.1 Math Equations

You may want to display math equations in three distinct styles: inline, numbered or non-numbered display. Each of the three are discussed in the next sections.

3.1.1 Inline (In-text) Equations. A formula that appears in the running text is called an inline or in-text formula. It is produced by the **math** environment, which can be invoked with the usual `\begin . . . \end` construction or with the short form `$. . . $`. You can use any of the symbols and structures, from α to ω , available in LaTeX [Lamport 1986]; this section will simply show a few examples of in-text equations in context. Notice how this equation: $\lim_{n \rightarrow \infty} x = 0$, set here in in-line math style, looks slightly different when set in display style. (See next section).

3.1.2 Display Equations. A numbered display equation—one set off by vertical space from the text and centered horizontally—is produced by the **equation** environment. An unnumbered display equation is produced by the **displaymath** environment.

Again, in either environment, you can use any of the symbols and structures available in LaTeX; this section will just give a couple of examples of display equations in context. First, consider the equation, shown as an inline equation above:

$$\lim_{n \rightarrow \infty} x = 0 \quad (1)$$



Abb. 1. Sailing Frigate. Image generated by Andreas Both (2023).

Notice how it is formatted somewhat differently in the **displaymath** environment. Now, we’ll enter an unnumbered equation:

$$\sum_{i=0}^{\infty} x + 1$$

and follow it with another numbered equation:

$$\sum_{i=0}^{\infty} x_i = \int_0^{\pi+2} f \quad (2)$$

just to demonstrate LaTeX’s able handling of numbering.

The “figure” environment should be used for figures. One or more images can be placed within a figure. If your figure contains third-party material, you must clearly identify it as such, as shown in the example below.

Your figures (cf. Abb. 1 and 2) should contain a caption which describes the figure to the reader.

Figure captions are placed *below* the figure.

Every figure should also have a figure description unless it is purely decorative. These descriptions convey what’s in the image to someone who cannot see it. They are also used by search engine crawlers for indexing images, and when images cannot be loaded.

A figure description must be unformatted plain text less than 2000 characters long (including spaces). **Figure descriptions should not repeat the figure caption – their purpose is to capture important information that is not already provided in the caption or the main text of the paper.** For figures that convey important and complex new information, a short text description may not be adequate. More complex alternative descriptions can be placed in an appendix and referenced in a short figure description. For example, provide a data table capturing the information in a

Tabelle 2. Some Typical Commands (table with full page width)

Command	A Number	Comments
<code>\author</code>	100	Author
<code>\table</code>	300	For tables
<code>\table*</code>	400	For wider tables



Abb. 2. Meerkats in nature working on laptops. Image by Andreas Both (2023). (image with full page width)

bar chart, or a structured list representing a graph. For additional information regarding how best to write figure descriptions and why doing this is so important, please see <https://www.acm.org/publications/taps/describing-figures/>.

3.2 The “Teaser Figure”

A “teaser figure” is an image, or set of images in one figure, that are placed after all author and affiliation information, and before the body of the article, spanning the page. If you wish to have such a figure in your article, place the command immediately before the `\maketitle` command:

```
\begin{teaserfigure}
  \includegraphics[width=\textwidth]{sampleteaser}
  \caption{figure caption}
  \Description{figure description}
\end{teaserfigure}
```

3.3 Citations and Bibliographies

Citations and references are numbered by default. A small number of ACM publications have citations and references formatted in the “author year” style; for these exceptions, please include this command in the **preamble** (before the command “`\begin{document}`”) of your \LaTeX source:

```
\citestyle{acmauthoryear}
```

4 DISKUSSION

(Einordnung, Interpretation und Bewertung der Erkenntnisse – (nachvollziehbare, begründbare) Meinungen sind erlaubt)

Some examples. A paginated journal article [Abril and Plant 2007], an enumerated journal article [Cohen et al. 2007], a reference to an entire issue [Cohen 1996], a monograph (whole book) [Kosiur 2001],

a monograph/whole book in a series (see 2a in spec. document) [Harel 1979], a divisible-book such as an anthology or compilation [Editor 2007] followed by the same example, however we only output the series if the volume number is given [Editor 2008] (so Editor00a’s series should NOT be present since it has no vol. no.), a chapter in a divisible book [Spector 1990], a chapter in a divisible book in a series [Douglass et al. 1998], a multi-volume work as book [Knuth 1997], a couple of articles in a proceedings (of a conference, symposium, workshop for example) (paginated proceedings article) [Ander 1979; Hagerup et al. 1993], a proceedings article with all possible elements [Smith 2010], an example of an enumerated proceedings article [Gundy et al. 2007], an informally published work [Harel 1978], a couple of preprints [Anzaroot et al. 2014; Bornmann et al. 2019], a doctoral dissertation [Clarkson 1985], a master’s thesis: [Anisi 2003], an online document / world wide web resource [Ablamowicz and Fauser 2007; Poker-Edge.Com 2006; Thornburg 2001], a video game (Case 1) [Obama 2008] and (Case 2) [Novak 2003] and [Lee 2005] and (Case 3) a patent [Scientist 2009], work accepted for publication [Rous 2008], ‘YYYYb’-test for prolific author [Saeedi et al. 2010a] and [Saeedi et al. 2010b]. Other cites might contain ‘duplicate’ DOI and URLs (some SIAM articles) [Kirschmer and Voight 2010]. Boris / Barbara Beeton: multi-volume works as books [Hörmander 1985b] and [Hörmander 1985a]. A couple of citations with DOIs: [IEEE 2004; Kirschmer and Voight 2010]. Online citations: [Thornburg 2001; TUG 2017; Veytsman 2017]. Artifacts: [R Core Team 2019] and [Anzaroot and McCallum 2013].

5 ZUSAMMENFASSUNG UND AUSBLICK

(Überblick über die gesamte Arbeit, Rückführung auf Aussagen aus Kapitel 1 durchführen, offene Punkte als neue Forschungsfragen definieren)

Papers may be written in languages other than English or include titles, subtitles, keywords and abstracts in different languages (as a rule, a paper in a language other than English should include an English title and an English abstract). Use `language=...` for every language used in the paper. The last language indicated is the main language of the paper.

The title, subtitle, keywords and abstract will be typeset in the main language of the paper. The commands `\translatedXXX`, `XXX` begin title, subtitle and keywords, can be used to set these elements in the other languages. The environment `translatedabstract` is used to set the translation of the abstract. These commands and environment have a mandatory first argument: the language of the second argument. See `sample-sigconf-i13n.tex` file for examples of their usage.

LITERATUR

- Rafal Ablamowicz and Bertfried Fauser. 2007. *CLIFFORD: a Maple 11 Package for Clifford Algebra Computations, version 11*. Retrieved February 28, 2008 from <http://math.tntech.edu/rafal/cliff11/index.html>
- Patricia S. Abril and Robert Plant. 2007. The patent holder's dilemma: Buy, sell, or troll? *Commun. ACM* 50, 1 (Jan. 2007), 36–44. <https://doi.org/10.1145/1188913.1188915>
- Sten Ander. 1979. Predicate Path expressions. In *Proceedings of the 6th. ACM SIGACT-SIGPLAN symposium on Principles of Programming Languages (POPL '79)*. ACM Press, New York, NY, 226–236. <https://doi.org/10.1145/567752.567774>
- David A. Anisi. 2003. *Optimal Motion Control of a Ground Vehicle*. Master's thesis. Royal Institute of Technology (KTH), Stockholm, Sweden.
- Sam Anzaroot and Andrew McCallum. 2013. *UMass Citation Field Extraction Dataset*. Retrieved May 27, 2019 from <http://www.iesl.cs.umass.edu/data/data-umasscitationfield>
- Sam Anzaroot, Alexandre Passos, David Belanger, and Andrew McCallum. 2014. Learning Soft Linear Constraints with Application to Citation Field Extraction. *arXiv:1403.1349*
- Lutz Bornmann, K. Brad Wray, and Robin Haunschild. 2019. Citation concept analysis (CCA)—A new form of citation analysis revealing the usefulness of concepts for other researchers illustrated by two exemplary case studies including classic books by Thomas S. Kuhn and Karl R. Popper. *arXiv:1905.12410 [cs.DL]*
- Kenneth L. Clarkson. 1985. *Algorithms for Closest-Point Problems (Computational Geometry)*. Ph. D. Dissertation. Stanford University, Palo Alto, CA. UMI Order Number: AAT 8506171.
- Jacques Cohen (Ed.). 1996. Special issue: Digital Libraries. *Commun. ACM* 39, 11 (Nov. 1996).
- Sarah Cohen, Werner Nutt, and Yehoshua Sagie. 2007. Deciding equivalences among conjunctive aggregate queries. *J. ACM* 54, 2, Article 5 (April 2007), 50 pages. <https://doi.org/10.1145/1219092.1219093>
- Bruce P. Douglass, David Harel, and Mark B. Trakhtenbrot. 1998. Statecharts in use: structured analysis and object-orientation. In *Lectures on Embedded Systems*, Grzegorz Rozenberg and Frits W. Vaandrager (Eds.). Lecture Notes in Computer Science, Vol. 1494. Springer-Verlag, London, 368–394. https://doi.org/10.1007/3-540-65193-4_29
- Ian Editor (Ed.). 2007. *The title of book one* (1st. ed.). The name of the series one, Vol. 9. University of Chicago Press, Chicago. <https://doi.org/10.1007/3-540-09237-4>
- Ian Editor (Ed.). 2008. *The title of book two* (2nd. ed.). University of Chicago Press, Chicago, Chapter 100. <https://doi.org/10.1007/3-540-09237-4>
- Matthew Van Gundy, Davide Balzarotti, and Giovanni Vigna. 2007. Catch me, if you can: Evading network signatures with web-based polymorphic worms. In *Proceedings of the first USENIX workshop on Offensive Technologies (WOOT '07)*. USENIX Association, Berkeley, CA, Article 7, 9 pages.
- Torben Hagerup, Kurt Mehlhorn, and J. Ian Munro. 1993. Maintaining Discrete Probability Distributions Optimally. In *Proceedings of the 20th International Colloquium on Automata, Languages and Programming (Lecture Notes in Computer Science, Vol. 700)*. Springer-Verlag, Berlin, 253–264.
- David Harel. 1978. *LOGICS of Programs: AXIOMATICS and DESCRIPTIVE POWER*. MIT Research Lab Technical Report TR-200. Massachusetts Institute of Technology, Cambridge, MA.
- David Harel. 1979. *First-Order Dynamic Logic*. Lecture Notes in Computer Science, Vol. 68. Springer-Verlag, New York, NY. <https://doi.org/10.1007/3-540-09237-4>
- Lars Hörmander. 1985a. *The analysis of linear partial differential operators. III*. Grundlehren der Mathematischen Wissenschaften [Fundamental Principles of Mathematical Sciences], Vol. 275. Springer-Verlag, Berlin, Germany. viii+525 pages. Pseudodifferential operators.
- Lars Hörmander. 1985b. *The analysis of linear partial differential operators. IV*. Grundlehren der Mathematischen Wissenschaften [Fundamental Principles of Mathematical Sciences], Vol. 275. Springer-Verlag, Berlin, Germany. vii+352 pages. Fourier integral operators.
- IEEE. 2004. IEEE TCSC Executive Committee. In *Proceedings of the IEEE International Conference on Web Services (ICWS '04)*. IEEE Computer Society, Washington, DC, USA, 21–22. <https://doi.org/10.1109/ICWS.2004.64>
- Markus Kirschmer and John Voight. 2010. Algorithmic Enumeration of Ideal Classes for Quaternion Orders. *SIAM J. Comput.* 39, 5 (Jan. 2010), 1714–1747. <https://doi.org/10.1137/080734467>
- Donald E. Knuth. 1997. *The Art of Computer Programming, Vol. 1: Fundamental Algorithms (3rd. ed.)*. Addison Wesley Longman Publishing Co., Inc.
- David Kosiur. 2001. *Understanding Policy-Based Networking* (2nd. ed.). Wiley, New York, NY.
- Leslie Lamport. 1986. *TeX: A Document Preparation System*. Addison-Wesley, Reading, MA.
- Newton Lee. 2005. Interview with Bill Kinder: January 13, 2005. Video. *Comput. Entertain.* 3, 1, Article 4 (Jan.-March 2005). <https://doi.org/10.1145/1057270.1057278>
- Dave Novak. 2003. Solder man. Video. In *ACM SIGGRAPH 2003 Video Review on Animation theater Program: Part I - Vol. 145 (July 27–27, 2003)*. ACM Press, New York, NY, 4. <https://doi.org/99.9999/woot07-S422> <http://video.google.com/videoplay?docid=6528042696351994555>
- Barack Obama. 2008. A more perfect union. Video. Retrieved March 21, 2008 from <http://video.google.com/videoplay?docid=6528042696351994555>
- Poker-Edge.Com. 2006. Stats and Analysis. Retrieved June 7, 2006 from <http://www.poker-edge.com/stats.php>
- R Core Team. 2019. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>
- Bernard Rous. 2008. The Enabling of Digital Libraries. *Digital Libraries* 12, 3, Article 5 (July 2008). To appear.
- Mehdi Saeedi, Morteza Saheb Zamani, and Mehdi Sedighi. 2010a. A library-based synthesis methodology for reversible logic. *Microelectron. J.* 41, 4 (April 2010), 185–194.
- Mehdi Saeedi, Morteza Saheb Zamani, Mehdi Sedighi, and Zahra Sasanian. 2010b. Synthesis of Reversible Circuit Using Cycle-Based Approach. *J. Emerg. Technol. Comput. Syst.* 6, 4 (Dec. 2010).
- Joseph Scientist. 2009. The fountain of youth. Patent No. 12345, Filed July 1st., 2008, Issued Aug. 9th., 2009.
- Stan W. Smith. 2010. An experiment in bibliographic mark-up: Parsing metadata for XML export. In *Proceedings of the 3rd. annual workshop on Librarians and Computers (LAC '10, Vol. 3)*, Reginald N. Smythe and Alexander Noble (Eds.). Paparazzi Press, Milan Italy, 422–431. <https://doi.org/99.9999/woot07-S422>
- Asad Z. Spector. 1990. Achieving application requirements. In *Distributed Systems* (2nd. ed.), Sape Mullender (Ed.). ACM Press, New York, NY, 19–33. <https://doi.org/10.1145/90417.90738>
- Harry Thornburg. 2001. *Introduction to Bayesian Statistics*. Retrieved March 2, 2005 from <http://ccrma.stanford.edu/~jos/bayes/bayes.html>
- TUG. 2017. *Institutional members of the TeX Users Group*. Retrieved May 27, 2017 from <http://www.tug.org/instm.html>
- Boris Veytsman. 2017. *acmart—Class for typesetting publications of ACM*. Retrieved May 27, 2017 from <http://www.ctan.org/pkg/acmart>

A ANHANG 1

A.1 Übungsaufgaben

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Morbi malesuada, quam in pulvinar varius, metus nunc fermentum urna, id sollicitudin purus odio sit amet enim. Aliquam ullamcorper eu ipsum vel mollis. Curabitur quis dictum nisl. Phasellus vel semper risus, et lacinia dolor. Integer ultricies commodo sem nec semper.

A.2 Part Two

Etiam commodo feugiat nisl pulvinar pellentesque. Etiam auctor sodales ligula, non varius nibh pulvinar semper. Suspendisse nec lectus non ipsum convallis congue hendrerit vitae sapien. Donec at laoreet eros. Vivamus non purus placerat, scelerisque diam eu, cursus ante. Etiam aliquam tortor auctor efficitur mattis.

B ANHANG 2

Nam id fermentum dui. Suspendisse sagittis tortor a nulla mollis, in pulvinar ex pretium. Sed interdum orci quis metus euismod, et sagittis enim maximus. Vestibulum gravida massa ut felis suscipit congue. Quisque mattis elit a risus ultrices commodo venenatis eget dui. Etiam sagittis eleifend elementum.

Nam interdum magna at lectus dignissim, ac dignissim lorem rhoncus. Maecenas eu arcu ac neque placerat aliquam. Nunc pulvinar massa et mattis lacinia.

C ANHANG 3

...