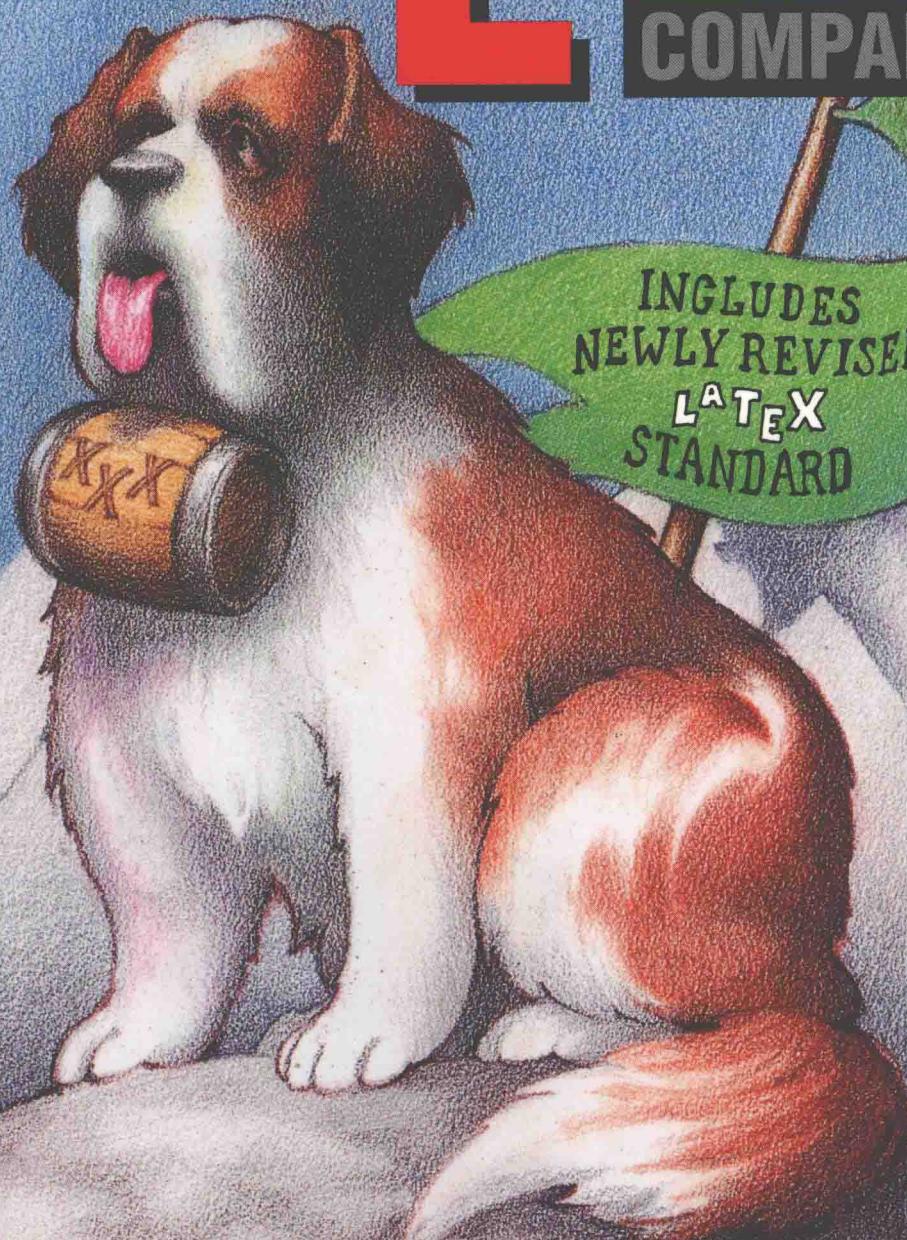


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The L^AT_EX Companion

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TO OUR WIVES
ALBINA, CHRISTEL, AND TATIANA
AND SONS
ALEXEI, ANDREI, ARNO, NICOLAS, AND ROMAN
FOR THEIR PATIENCE AND UNDERSTANDING.

Preface

\LaTeX is a generic typesetting system that uses \TeX as its formatting engine. This companion is a detailed guide through the visible and not-so-visible beauties of \LaTeX . As such, it is a comprehensive treatise of those points not fully discussed in Leslie Lamport's \LaTeX : *A Document Preparation System* (henceforth referred to as the \LaTeX book) [49]. Extensions to basic \LaTeX , as described in that book, are discussed, so that the \LaTeX book, together with this companion, provide a ready reference to the full functionality of the \LaTeX system.

Due to its flexibility, ease of use, and professional typographic quality, \LaTeX is presently used in almost all areas of science and the humanities. Unlike many word processors, \LaTeX (and its underlying formatting engine \TeX) comes free of charge and is not linked to any particular computer architecture or operating system. Since \LaTeX source files are plain text files, it is possible to ship them, and the packages referenced, from any computer to any other computer in the world (over electronic networks or via normal mail). The recipient will be able to obtain a final output copy identical to the one generated at the sender's site, independently of the hardware used. Thus members of groups, geographically spread over several sites in different countries, or even on different continents, can now work together in composing complex documents where different parts can be dealt with by different individuals, and then brought together without problems. Moreover, the use of electronic manuscripts has the potential to speed up the publication of papers by publishers.

\LaTeX is not difficult to learn and a beginner can benefit from the system after reading through the first few chapters of Lamport's \LaTeX book, the basic reference on \LaTeX . After some experience, you will probably have to solve some more advanced problems whose solution cannot be found directly in that book. If you are one of those users who would like to know how \LaTeX can be extended

to create the nicest documents possible without becoming a (L^A)T_EX guru¹, then this book is for you.

You will be guided, step by step, through the various important areas of L^AT_EX and be shown the links that exist between them. The structure of a L^AT_EX document, the basic formatting tools, and the layout of the page are all dealt with in great detail. A sufficient library of packages in the area of floats, graphics, tables, PostScript, and multi-language support are presented in a convenient way. This book is the first volume to include all of the important L^AT_EX tools, such as: up-to-date descriptions of version 2 of the New Font Selection Scheme (NFSS2), the *A_MS-L^AT_EX* mathematics extensions, the *epic* and *eepic* extensions to L^AT_EX's *picture* environment, and the *MakeIndex* and *BibT_EX* programs for producing and controlling the generation of indices and bibliographic references. Finally, an overview of ways to define new commands and environments, lengths, boxes, general lists, etc., as well as ways of facilitating the handling of these objects, complete the picture.

All three of us have been involved for several years in the support and development of L^AT_EX applications in various professional environments and countries. We have taught the secrets of L^AT_EX to many different audiences, and have been listening to the user community by following the discussions in the text processing related news groups and at T_EX conferences. This has allowed us to gather a coherent view of a vast collection of subjects, which, we think, you might need one day if you want to fully exploit the richness and strengths of the L^AT_EX system. Note, however, that this book is not a replacement for, but a companion to, the L^AT_EX book. You are assumed to have read the first part of that book, and in any case, it should be considered a reference for precise and full description of the L^AT_EX commands.

To make the presented information even more complete and useful, our readers are kindly invited to send their comments, suggestions, or remarks to any one of the authors. We shall be glad to correct any remaining mistakes or oversights in a future edition, and are open to suggestions for improvements or the inclusion of important developments that we may have overlooked.

L^AT_EX 2_ε—The New L^AT_EX Release

Over the years many extensions have been developed for L^AT_EX with one unfortunate result: incompatible L^AT_EX formats came into use at different sites. Thus, to process documents from various places, a site maintainer was forced to keep L^AT_EX (with and without NFSS), S_LT_EX, *A_MS-L^AT_EX*, and so on. In addition, when looking at a source file it was not always clear what format the document was written for.

¹A (L^A)T_EX guru is a person knowing the internals of both L^AT_EX and primitive T_EX by heart. In this book we use the logo (L^A)T_EX whenever we refer to both T_EX and L^AT_EX.

To put an end to this unsatisfactory situation a new L^AT_EX release was announced for fall 1993 that brings all such extensions back under a single format and thus prevents the proliferation of mutually incompatible dialects of L^AT_EX 2.09. With L^AT_EX 2_ε the new font selection will be standard and style files like `amstex` (formerly $\mathcal{A}\mathcal{M}\mathcal{S}$ -L^AT_EX format) or `slides` (formerly S_LL^AT_EX format) will become extension packages, all working with the same base format. The introduction of a new release also made it possible to add a small number of often-requested features (like an extended version of `\newcommand`). All the new possibilities are described in this book, thus allowing you to make full use of the new L^AT_EX release.

To make it easy to distinguish between old L^AT_EX 2.09 sources and new sources (making use of new features), the first command in a L^AT_EX document was changed from `\documentstyle` to `\documentclass`, thus enabling the software to automatically detect an old source file and switch to compatibility mode if necessary.

The L^AT_EX3 Project

L^AT_EX is presently being rewritten under the coordination of one of the authors (Frank Mittelbach), Chris Rowley and Rainer Schöpf. This endeavor is called the L^AT_EX3 Project [57]. A lot of the functionality described in this book as extensions to basic L^AT_EX will be available in that system: as part of the kernel, or in one of the extension packages. To help funding, half of the royalties from this book will go directly to the L^AT_EX3 Project. Therefore, when buying this book, you not only obtain a handy, complete, and up-to-date reference to many important and useful packages available with L^AT_EX today, but you also actively contribute to making L^AT_EX more powerful and user-friendly in the future.

Acknowledgments

We first of all wish to thank Peter Gordon, our editor at Addison-Wesley, who not only made this book possible, but through his constant encouragement kept us on the right track. His suggestions and ideas made the companion richer, both in content and in form. We also wish to acknowledge Marsha Finley, of *Superscript* Editorial Production Services, for the efficiency with which she helped us with the practical aspects relating to the preparation of this book. Helen Goldstein, associate editor at Addison-Wesley, was always ready to advise us whenever we asked.

We gratefully recognize all of our many colleagues in the (L^A)T_EX world who developed the packages, not only those described here, but also the hundreds of others, which help users typeset their documents better and faster. Without the continuous effort of all these enthusiasts, L^AT_EX would not be the magnificent

and flexible tool it is today. We hope we have done some justice to them by mentioning, when first describing a given package, the original author and/or other major contributors, as far as this information was known to us.

We are especially indebted to Johannes Braams, David Carlisle, Michael Downes, Sebastian Rahtz, and Rainer Schöpf for their careful reading of the manuscript. Their numerous comments, suggestions, corrections, and hints have substantially improved the quality of the text. Roger Woolnough proof-read an early version of the manuscript, Silvio Levy the chapter on NFSS. Finally we want to express our gratitude to CERN for allowing us to use its computer facilities for preparing the compuscript.

How to Read This Book

The titles of the various chapters should convey relatively clearly the subject area addressed in each case. In principle, all chapters can be read more or less independently and, if necessary, pointers are given to where complementary information can be found in other parts of the book.

- Chapter 1** gives a short introduction to the \LaTeX system.
- Chapter 2** discusses generic and document-oriented markup.
- Chapter 3** describes \LaTeX 's basic typesetting commands.
- Chapter 4** explains which tools are available to globally define the visual layout of the pages of a document by using pagestyles.
- Chapter 5** shows how to assemble material into columns and rows with the extended `tabular` and `array` environments, and their multipage equivalents—`supertabular` and `longtable`.
- Chapter 6** provides a general treatment of floating material.
- Chapter 7** discusses in detail \LaTeX 's New Font Selection Scheme (NFSS2) and presents its various user commands. It is shown how to add new fonts, both in math and text mode.
- Chapter 8** reviews the `amstex` package, which adds many powerful typesetting commands in the field of mathematics.
- Chapter 9** looks at the problem of using \LaTeX in the multi-language or non-English environment. The `babel` system and other language-specific packages are described.
- Chapter 10** addresses the field of device-independent graphics showing how the `epic`, `eepic` and other packages extend the possibilities of \LaTeX 's basic `picture` environment.

-
- Chapter 11** shows how the PostScript page description language not only can turn L^AT_EX into a full-blown graphics utility, but also how it makes it possible, via the NFSS, for a user to choose a font from amongst hundreds of font families, available as PostScript Type 1 outlines.
- Chapter 12** tackles the problems associated with preparing an index. The program *MakeIndex* is described in detail.
- Chapter 13** surveys how L^AT_EX's companion program B_BT_EX tries to solve problems related to maintaining bibliographic data bases. Various existing bibliographic styles are discussed and the format of the B_BT_EX language used in the style files is presented in detail, allowing the user to customize an existing style.
- Chapter 14** shows how to document L^AT_EX files using the doc package and its companion program DOCSTRIP.
- Appendix A** first reviews how to handle and manipulate the basic L^AT_EX programming structures. The extensions introduced by the calc package in the field of arithmetic operations, and extended control structures added to L^AT_EX 2_ε are discussed.²
- Appendix B** explains how to get the files described in this book from the various T_EX archives or from the T_EX Users Groups.

In order to make the examples as independent as possible from basic T_EX, extensive use has been made of the packages calc and ifthen, which are described in the appendices A.4 and A.5. You should study the extensions to L^AT_EX, introduced in these packages, if you want to understand how many of the examples in this book function in detail.

Many examples make use of new features in L^AT_EX 2_ε; especially font changes for text are all done in L^AT_EX 2_ε style, i.e., with the commands shown in table 7.2 on page 171. Abbreviated forms, like `{\bf word}` are normally not used, since they are style defined commands and may or may not be available for all classes of documents.

While it is certainly possible to make good use of most parts of this book within a L^AT_EX 2.09 environment (the event of L^AT_EX 2_ε happened after 90% of the book was finished) we suggest that you upgrade to the new version as soon as possible so that the worldwide community of L^AT_EX users again speaks a single language. As said above, L^AT_EX 2_ε is able to identify and process old documents written for L^AT_EX 2.09. However, packages written or updated for L^AT_EX 2_ε will not run with the old system.

²In L^AT_EX 2.09 programming structures like if-then-else were made available in the package ifthen; in L^AT_EX 2_ε this package is extended and enhanced.

Typographic Conventions

As explained in the discussion about the links between content and form or generic and layout markup, it is essential that the presentation of the material conveys immediately its function in the framework of the text. Therefore, we present below the typographic conventions used in this book.

L^AT_EX command and environment names are in monospaced type (for example, `\caption`, `enumerate`, `\begin{tabular}`), while names of package and class files are in sans-serif type (e.g., `article`).

The syntax of L^AT_EX constructs is presented inside a rectangular box. Command arguments are shown in italic type.

`\commandname{arg1}{arg2}{arg3}`

Lines containing examples with L^AT_EX commands are indented and are typeset in a monospaced type at a size somewhat smaller than that of the main text.

```
\chapter{Title of the Chapter}
\section{Section Title}
Some text...
```

When it is important to show the result of a series of commands, then the input and output are shown side by side as follows:

The right column shows the input text to be treated by L^AT_EX. In the left column one sees the result after typesetting.

The right column shows the input text to be treated by `\LaTeX{}`. In the left column one sees the result after typesetting.

For large examples, where the input and output cannot be shown conveniently alongside one another, the following layout is used:

Input text
This is a wide line, whose input commands and output result cannot be shown nicely in two columns.
This is a wide line, whose input commands and output result cannot be shown nicely in two columns.
Output text

Cross-references to page numbers where a given subject is treated in Leslie Lamport's L^AT_EX book are shown in the margin in parentheses and are preceded by a calligraphic \mathcal{L} , as seen here. They correspond to the page numbers as they

were in the first edition that described L^AT_EX 2.09; all differences to L^AT_EX 2_ε are noted in this book.

Commands to be typed by the user on a computer terminal are shown in monospaced type and are underlined, e.g.: This is user input.

Using All Those Packages

In this book we describe over 150 packages and options that extend or modify L^AT_EX's basic possibilities. In order to show their action, we (in principle) have to load them all at the same time. For various reasons that is impractical, if not impossible. Indeed many packages, like `program`, use up a lot of counters, and T_EX only allows a total of 256 counters. Therefore, when you hit this limit you must reduce the number of files you load simultaneously. In the production of this book we used a different strategy: we prepared some of the examples as separate files and included them as Encapsulated PostScript. Moreover, we used the package `hackalloc`. It redefines the allocation primitive so that *all* allocation becomes group-local. This means that by loading packages only when they are needed inside a brace group, the counter and length variables will be deallocated when you exit from the group. This procedure, however, can have some side effects, and should only be used with great care. However, we used most of the packages together, with the result that we had to recompile T_EX several times during the preparation of this book. One of the log files produced during the last steps of the preparation showed the following summary:

```
Here is how much of TeX's memory you used:
 9692 strings out of 16716
118315 string characters out of 133654
236569 words of memory out of 262141
 8131 multiletter control sequences out of 9500
 81058 words of font info for 228 fonts, out of 90000 for 255
 20 hyphenation exceptions out of 607
 34i,23n,41p,509b,1403s stack positions out of 300i,40n,60p,3000b,4000s
Output written on companion.dvi (555 pages, 2008780 bytes).
```

As you can see, we nearly reached the font limit (which cannot be raised further) because of the many fonts shown in chapter 7, and the usage for strings, characters, main memory, and control sequences is probably much higher than in any L^AT_EX run you ever made. This is not surprising given that the whole book is produced in a single L^AT_EX run with all those packages working together to produce the examples.

Even when you do not reach a limit of the kind mentioned above, there are other interference effects between different packages. For instance, some extensions such as `french` make some characters active (i.e., some characters act as though they were control sequences). Problems may result when such a

character is then encountered in another package. This means that not all of the packages described in this book can be used together. Sometimes you can solve the problem by loading problematic packages as one of the last `\usepackage` declarations. Also, some packages make the `@` character active (e.g., `amstex`), and this can have nasty consequences if you load other packages that use the `@` character.

As a rule of thumb, if you observe some odd behavior when you add a package to an existing list of packages, which seemed to work nicely together before, there might be a compatibility problem. Try loading the new file at the end, and if that does not work, take out each of the other files one by one. In this way you might find the file or files that are responsible for the problem.

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