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## Designing and producing a reference book with $\LaTeX$ : *The Engineer's Quick Reference Handbook*

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### Abstract

This article describes the process of designing an Italian reference book, namely *Il prontuario dell'ingegnere*. As a reference work it shares the characteristics of any other such book; it also uses a large amount of mathematics and contains a large number of graphics insertions. Moreover, the publisher wanted to distribute the work both as a regular bound book and as a computer file to be read directly on the computer screen.

### 1 Introduction

In the first half of the nineties, Andrea Guadagni (AG) asked Claudio Beccari (CB) to collaborate on the production of a ‘Quick Reference’ handbook, in a thinner and more comfortable format than the historical and bulky landmark volume for engineers, the *Manuale dell'ingegnere* (The Engineer’s Handbook) by Colombo<sup>1</sup> [2]. This Quick Reference handbook was planned to be published at the publishing company Hoepli, well-known in Italy for its collection of handbooks in every possible discipline. The general idea was that the Quick Reference should be a collection of records, each one on a particular subject, with a minimum of mathematics, preferably self-contained and without reference to other records.

As the editor of the huge “Manuale”, AG had all the necessary experience for finding the experts, for organising the material to be published, and for managing the whole publishing process. Eventually he also took care of the source file editing.

On the other side, CB already had some experience with  $\LaTeX$  design and layout, but the production of the “Quick Reference” was a new challenge that required a very close interaction between AG and CB.

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Editor’s note: This is a translation of the article “La progettazione di un’opera di consultazione: l’edizione del *Prontuario dell'ingegnere* con  $\LaTeX$ ”, which first appeared in *ArsTeXnica* issue #4 (October 2007), pp. 16–24. Reprinted with permission. Translation by the author.

<sup>1</sup> Professor Colombo’s first name was Giuseppe, but the handbook was and still is simply named “Il manuale del Colombo” (Colombo’s handbook) or “il Colombo” by every engineer, no matter the specialization.

### 2 $\LaTeX$ in the nineties

First of all it may be useful to mention some questions concerning computers and programming that today are obsolete, but at the time were a real problem; mentioning these problems is of general interest in every cooperative work when many authors are involved. Moreover, even if advances in the computer world have eradicated several incompatibilities, often new ones arise, producing new problems. It is advisable that authors who want to produce a cooperative document be aware of these problems and know how to overcome the difficulties that they might encounter along their path.

One of the problems was the fact that CB, AG and the various collaborators used different platforms. CB was still working with a DOS PC; Windows 95 had just appeared but it was not so widespread on existing PCs. Windows 3.1 was still too rudimentary for this kind of work, for one thing because its graphic interface used most of the memory available to those PCs. Moreover, CB was still working with  $\LaTeX$  2.09, although by the end of the work  $\LaTeX$  2 $\epsilon$  was available; as usual at that time he was using a plain ASCII editor and ran the various  $\LaTeX$  connected applications with suitable command lines.

On the other hand, AG was working with a Macintosh, whose operating system was very different from the simple DOS from many points of view, not least that paths were described in a very different way. Obviously it had a beautiful graphic interface, but this was more or less irrelevant for the goal of the production of this work. Concerning the  $\TeX$  system, AG was using Textures; this was (and still is) a commercial product by BlueSky Research and it worked both as an editor and as a synchronous previewer, that is, it employs two windows open simultaneously, in one of which the usual `.tex` source is edited while the other synchronously displays the result of typesetting at the same rate that text is input in the editor window.

Today, everything is simpler; plain DOS is almost forgotten; although the command window allows one to use a more modern DOS incarnation, most users appear to ignore its existence. Apple has recently changed the operating system of its Macintoshes, passing to Mac OS X, a Unix-based operating system with the typical Macintosh beautiful graphic interface.

On the  $\TeX$  system side, the  $\TeX$  Users Group and most other  $\TeX$  user groups distribute the free  $\TeX$  system through the  $\TeX$  Collection CDs and DVDs;  $\TeX$  Live is available for all platforms and

the differences between the various operating systems are managed in a unified way, so that the macro collections and the packages are more and more platform independent.

But in the nineties it was necessary to fight against the various ways of indicating absolute and relative paths: DOS and Unix used the slash / while Macintosh used the colon :, and in different positions from those where DOS and Unix would use /. This was relevant for the production of the Quick Reference handbook, because the subpaths where it was handy to keep the pictures and other included material had to be accessed on both systems. Just to give an idea of the code that had to be implemented, here are the macros that would automatically change the explicit path of a file containing a figure.

```
\newif\if@path \@pathfalse
% These macros were adapted from Knuth's
% TeXbook (pag. 375)
\def\check@figurefilepath#1{%
  \@chkfpM#1:\@chkfpM\@%
\if@path\else\@chkfpU#1/\@chkfpU\@}\fi}
%
\def\@chkfpM#1:#2#3\@{%
  \ifx\@chkfpM#2\@pathfalse\else
    \@pathtrue\fi}
\def\@chkfpU#1/#2#3\@{%
  \ifx\@chkfpU#2\@pathfalse\else
    \@pathtrue\fi}
%
% This is the macro that possibly prepends
% the path specification to the file name
% of a figure, then it checks if the
% folder or directory separators agree
% with the operating system; eventually it
% passes this generated full specification
% to the macro that includes the figure.
%
\parse@figure@filename#1{%
\def\figurefilename{#1}%
\ifx\def@ultpath\empty\else
  \expandafter\check@figurefilepath
  \expandafter{\figurefilename}%
\if@path\else
  \edef\figurefilename{%
    \def@ultpath\ifMacintosh:%
    \else/\fi\figurefilename}%
\fi
\fi
\ifMacintosh
  \expandafter\Mac@rename
  \figurefilename/\relax
\else
  \expandafter\UNIX@rename
  \figurefilename:\relax
\fi}
```

```
%
% Recursive macro that erases the slashes
% and sets the colons.
%
\def\Mac@rename#1/#2\relax{%
  \def\@tempA{#2}%
  \ifx\@tempA\empty
    \def\figurefilename{#1}%
  \else
    \def\@tempA{#1:#2}%
    \expandafter\remove@slash
    \@tempA\relax
  \expandafter\Mac@rename
  \figurefilename/\relax
\fi}
%
% Recursive macro that erases the colons
% and sets the slashes.
%
\def\UNIX@rename#1:#2\relax{%
  \def\@tempA{#2}%
  \ifx\@tempA\empty
    \def\figurefilename{#1}\else
    \def\@tempA{#1/#2}%
  \expandafter\remove@colon
  \@tempA\relax
  \expandafter\UNIX@rename
  \figurefilename:\relax
\fi}
%
% These macros erase the final slash
% or colon.
%
\def\remove@slash#1/\relax{%
  \def\figurefilename{#1}}
\def\remove@colon#1:\relax{%
  \def\figurefilename{#1}}
```

### 3 The layout of the book

For the typeset book AG and CB agreed on a layout where each record would be a freestanding section to be introduced with `\section`. Furthermore, each record should consist of a single spread: in the ‘paper’ version of the book, where pages are turned from right to left, it was necessary that the written part be typeset on an odd page (the recto page) on the right side of the spread, while the graphic contents of the record would appear on the verso of the previous sheet, an even page, i.e. on the left part of the spread. The sections were collected in chapters, and the latter in parts. Each part dealt with a particular branch of engineering, for example the part “Edilizia” (Building) would be divided in the chapters dealing with such chapters as “Foundations”, “Pillars”, “Roofs”, and the like; each chapter contained a few records concerning the details, with formulas, tables, drawings, descriptions, costs, etc.

The publishing house wanted also an “e-book” version of this reference book; in this electronic version, where pages scroll from bottom to top, but reading goes from left to right, the record should occupy a single screen, with the written part on the left and the graphic part on the right.

Both versions have thumbnails on the side of the page. In the paper version traditionally it would have been necessary to make a semicircular cut in the pages, as sometimes seen in large Holy Books, or in large dictionaries or encyclopedias. However, the high cost of this operation suggested we use a simpler method, namely to let the thumbnail shadow be visible on the external margin cut, by typesetting such thumbnails across the trimming area.

The electronic version had all the necessary internal links, but for consistency with the printed version it also contained various icons (thumbnails) on the left side.

Headers, footers, part titles, records, the table of contents and the index required a particular layout, partly because each page, each contents entry, and each chapter required the name of the individual author or the name of the chapter coordinator.

The source files for both the printed and the electronic version had to be identical and the output format chosen with a single option in the main file.

#### 4 Page layout and fonts

The trimmed page size was a standard ISO-A5, that is, 148 mm by 210 mm. The main text box, without headers and footers, was 116 mm by 175 mm. With such a compact text box, we decided to typeset the book with fonts of size 9/10 pt; we left the decision on the font collection to a later time, after attentive examination of the typesetting results with different typefaces. We eventually chose the Times fonts, because with Textures (at that time) they were easier to configure and use.

Figure 1 shows a spread of the printed version: the left page contains the drawings relative to the record or section, while the right page displays the text and the other relevant information. The thumbnail icon that characterizes the part [in the example: “Edilizia” (Building)] is on the right page. The part title is repeated on the left header, while the chapter title is only in the right header. The section title is centered above the text. The record is subdivided into small unnumbered subsections in line with the text. The section author is in the right footer while the left footer contains the book title and the publisher’s name.

Figure 2 contains in one screen shot more or less the same information, except that thumbnails, text

and drawings are interchanged with regard to ‘left’ and ‘right’ sides. There is just one header and one footer, the contents of which are flush to the external margins. The rest is identical to the printed version.

While the printed version had pages of size A5 that form a spread in a landscape A4, the electronic version has one screen shot in landscape with a page size (needed for the PDF output) of a landscape A4 sheet. The typesetting information for L<sup>A</sup>T<sub>E</sub>X had to be completely automatic, depending on the version to be output. If a screen shot had to be printed, either the landscape orientation must be compatible with the printer, or the latter should be capable of scaling the printed area to the paper width. This was a necessary warning at that time; today all printers are capable of printing in landscape mode.

#### 5 L<sup>A</sup>T<sub>E</sub>X commands for inputting records

The L<sup>A</sup>T<sub>E</sub>X input of this Quick Reference handbook obviously requires specific commands in order to cope with the specific requirements of the layout.

For example, the drawings of each record must be separately assembled, possibly with recourse to a graphics editor so as to produce a single graphic object to be included in the output file. At those times it was absolutely necessary to run L<sup>A</sup>T<sub>E</sub>X and produce output in DVI format, then passed through `dvips` in order to get the PostScript format, and finally to get the PDF format by running the `ps2pdf` program. Today it would be possible to get the same result with one pass through `pdflatex`. Nevertheless, once suitable macros were made available, it was easy to get the desired result for both the editor and the individual authors.

The macros for starting a new spread or a new chapter required only the specification of the pertinent title and the name of the author or editor.

The macros that started a new part had to provide the pointer to the specific thumbnail and to its typesetting on the proper margin in each version. The option `draf` had to be modified so that during the preliminary work the authors and the editor could save a lot of black ink by omitting printing the thumbnail, but leaving the explicit part title in the relevant margin.

The `babel` package at that time did not have the functionality it has today; in addition many Italian L<sup>A</sup>T<sub>E</sub>X users did not even know they could typeset with the rules of Italian typography and with Italian hyphenation, or they did not know how to configure their system; many were still working with L<sup>A</sup>T<sub>E</sub>X 2.09. So we created the necessary tests with suitable warning messages in order to assure at least

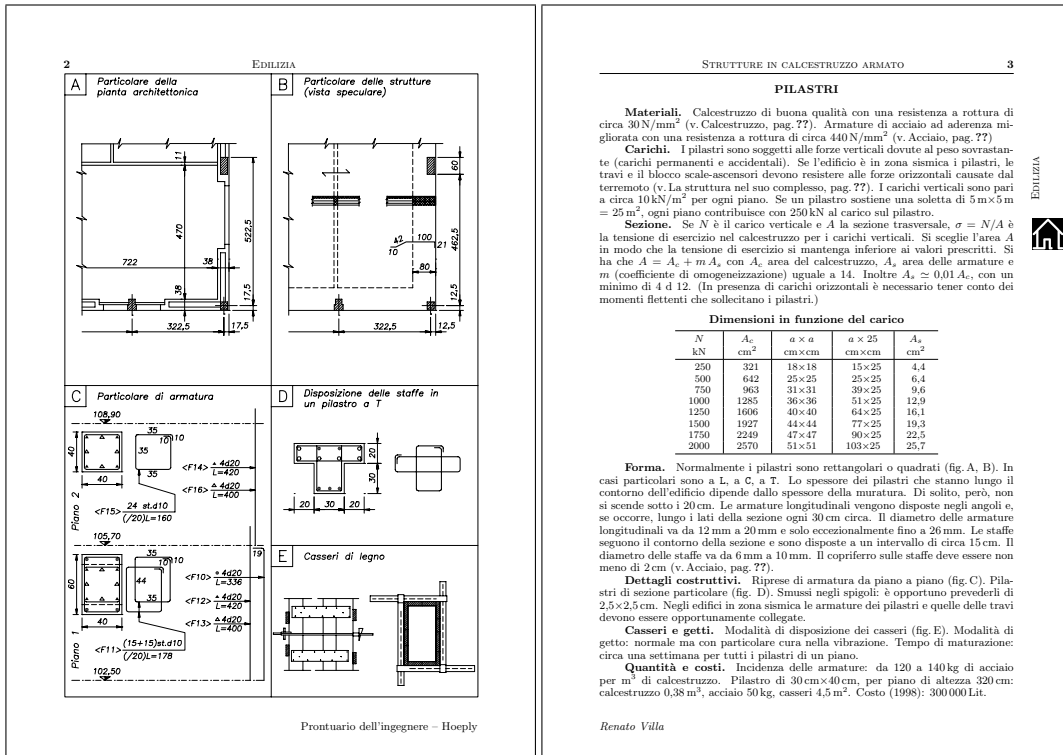


Figure 1: Printed version: a spread.

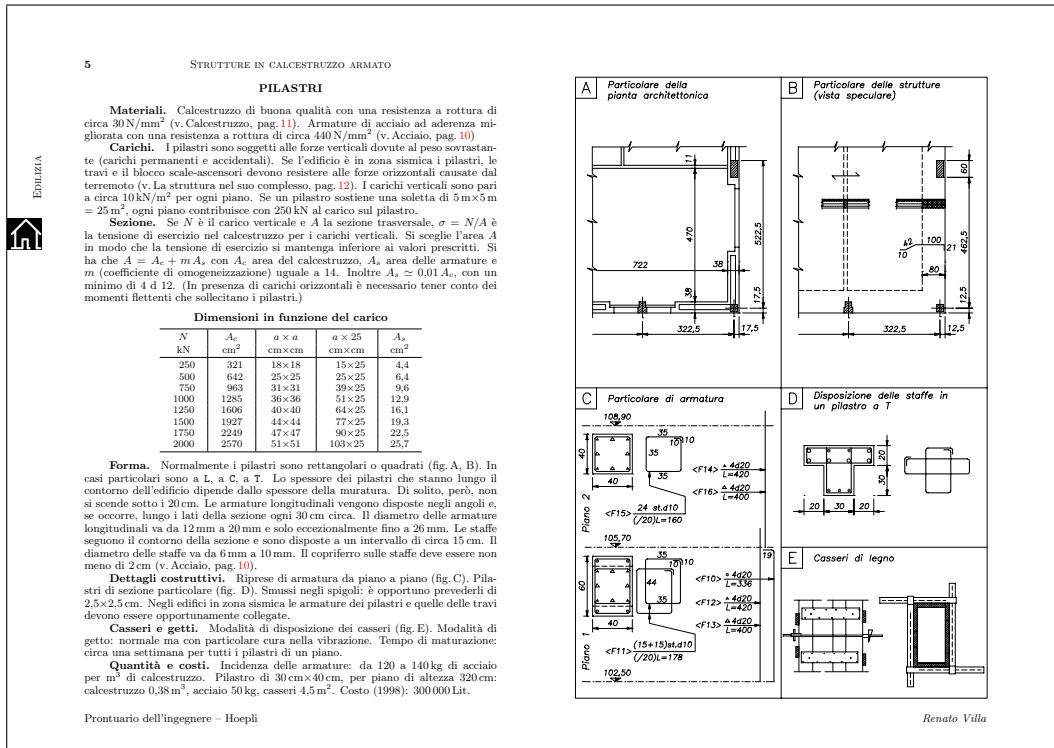


Figure 2: Electronic version: a screen shot corresponding to the same spread shown in figure 1.





























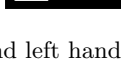
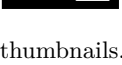
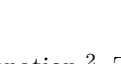

Part	Right icon	Left icon
Environment		
Chemistry		
Economy		
Building		
Electronics		
Power electrical eng.		
Energetics		
Hydraulics		
Computers		
Machines		
Production		
Survey		
Telecommunications		
Land planning		
Quality		
Miscellany		

Figure 3: Right and left hand thumbnails.

the use of Italian hyphenation.<sup>2</sup> The code was the following:

```
\expandafter
\ifx\csname language\endcsname\relax
\else
\expandafter
\ifx\csname l@italian\endcsname\relax
\typeout{La sillabazione per l'italiano
non e' definita.^J
Usero' la sillabazione di
default e faro' tanti errori!}%
\typeout{Verificare che la sillabazione
per l'italiano sia stata
caricata^^J
e che il suo nome sia associato
al comando \string\l@italian}%
```

<sup>2</sup> Even today, although everything is much simpler, many Italian users run L<sup>A</sup>T<sub>E</sub>X to typeset Italian texts without configuring it for Italian!



Figure 4: The thumbnail shadow on the trimmed side of the second edition.

```
\language0\righthyphenmin 2\relax
\lccode'\='\'
\else
\def\italianoof{\language \l@italian
\righthyphenmin 2\relax
\lccode'\='\'}%
\italiano
\fi
\fi
```

Well, today even these messages are built-in to the babel package, and warning messages are much simpler to program. (The first message says: “Italian hyphenation is undefined. I’ll use the default hyphenation and I’ll make a lot of errors!” The second message says: “Verify that Italian hyphenation has been loaded and that its name is associated to the command `\l@italian`”.)

## 6 Thumbnails

Concerning the thumbnail icons, we solved the problem by designing their fonts, with white strokes over a black background, and with the background extending well beyond the actual icon, so as to protrude into the right trimming area for the printed version, or to protrude well to the left of the virtual PDF sheet border for the electronic version. This solution guarantees the visibility of the inked icon shadow on the trimmed pages of the printed version, even without the typical thumbnail semicircular cut. Figure 3 shows the left and right icons, with the extending background; initially they were produced with METAFONT; but for the second edition they were traced and rendered as scalable outline Type 1 fonts.

Figure 3 displays the icons on a wide black rectangle, whose width goes beyond the trimmed page; this is why when pages are trimmed, the closed book exhibits on the right trimmed side the thumbnail shadows, figure 4; probably this fact is not so important while ‘navigating’ the handbook as the icon



**Figure 5:** The published editions; on the left the first edition in size A5; on the right the second edition in size 120 mm × 170 mm.

drawn on the flat side of the thumbnail — even when rapidly flipping the handbook pages it's very easy to identify the icon one is looking for. It goes without saying that the thumbnails of every part are progressively shifted down along the margin so that they appear still when pages are rapidly flipped.

Even the electronic version, although it has its icons on the left border and does not have pages to be flipped through one's fingers, benefits from the presence of such icons when the screen view is rapidly scrolled up or down by operating on the scrolling arrows of the PDF reading program.

## 7 Internal hyperlinks

The various elements of the electronic version are completely hyperlinked with one another by means of the `hyperref` package, so that surfing the document gets particularly simple when the colored anchor texts are clicked upon. Even the table of contents entries and the index entries are hyperlinked with their sources. The sections that must refer to other sections are also hyperlinked. In this way the electronic version is even more easily readable than the printed one. In the nineties this was a real novelty that has been appreciated by the readers.

## 8 The second edition modifications

The second edition [3] underwent a few layout modifications compared to the first edition. The page size was reduced to the trimmed page size of 120 mm by 170 mm, figure 5. The written and drawn parts of each record were interchanged as may be seen in figure 6. The thumbnails were set on the left side, as in the electronic version, but in both versions they were set a little closer to the text border. Together with figure 6 it's possible to examine a screen shot in figure 7. The thumbnail shadows remain visible on the trimmed page side, figure 4.

## 9 The publishing house policy

The Hoepli Publishing Company is very well known for its (Italian) handbooks and, among engineers, for its *Manuale del Colombo* (Colombo's Handbook). This work started in 1875 and was published in many successive revisions so as to become almost encyclopedic, since it can no longer be used as originally intended, as an easily workable handbook. We all know that engineering sciences have evolved in an incredible way in the past century, so that the evolution of Colombo's Handbook has been unavoidable. For these reasons, in our *Prontuario dell'Ingegnere* (The Engineer's Quick Reference Handbook),



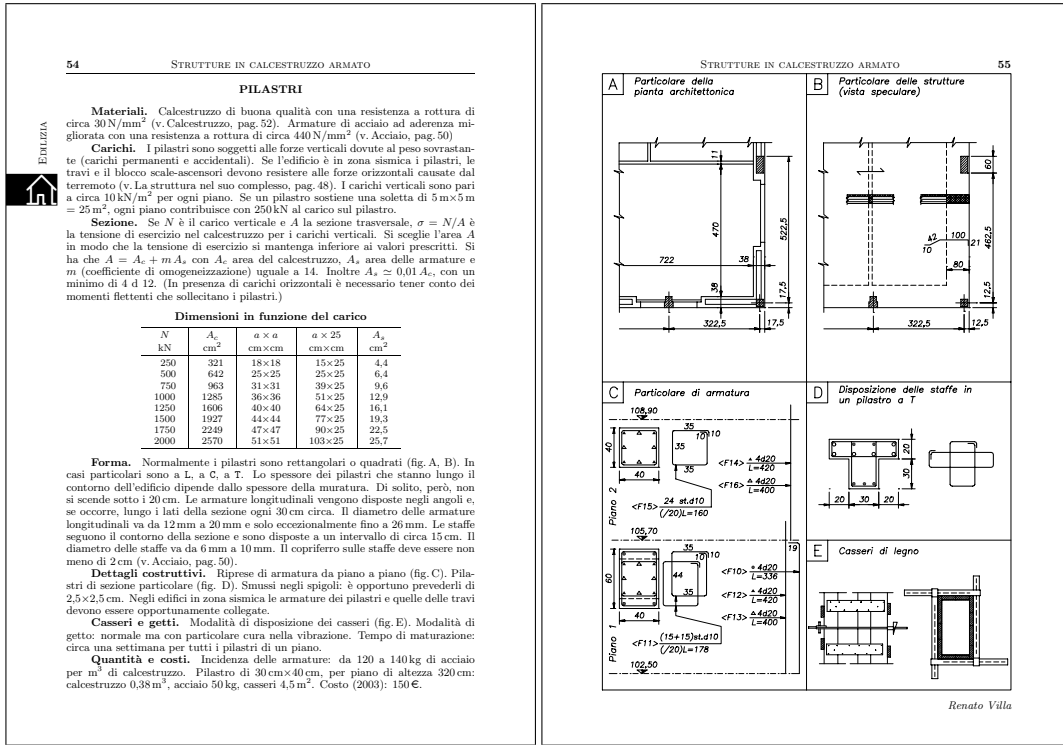


Figure 6: Second edition printed version: a spread.

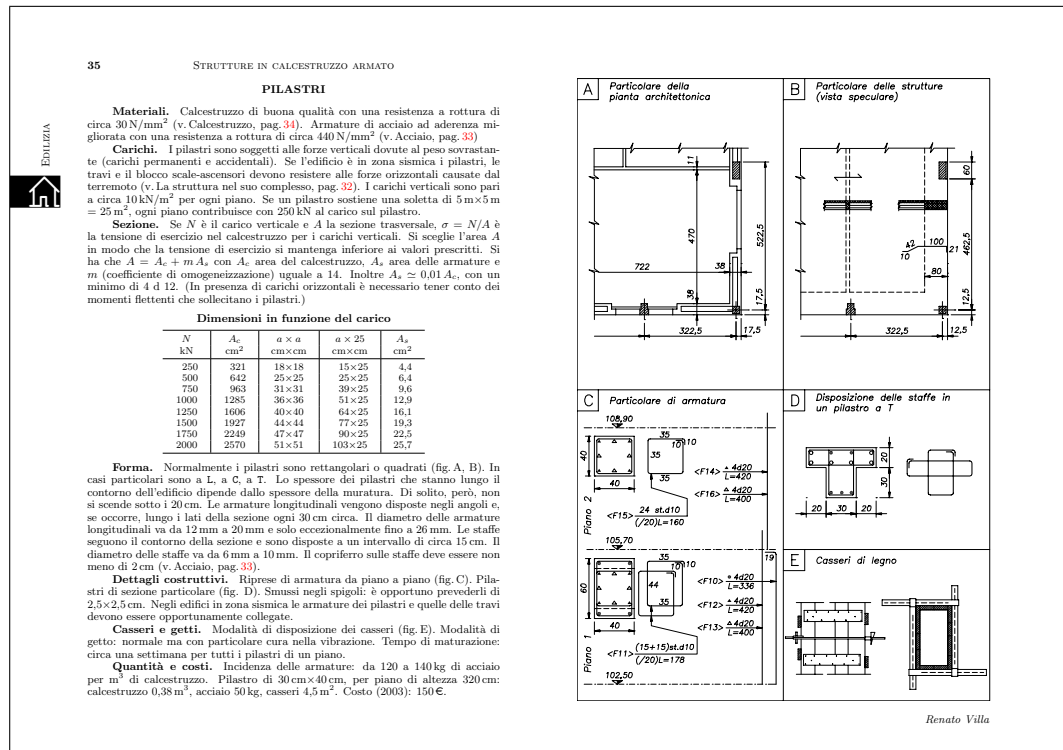


Figure 7: Second edition electronic version: a screen shot of the same spread shown in figure 6.

only the essential elements of the various engineering disciplines were included, and those condensed. The purpose is to give essential information to those who are not experts in a particular discipline, but want to understand the basic principles. This necessity arises also from the always increasing cooperation between engineers and architects, each expert in their respective fields. Therefore the Quick Reference meets the need of understanding one another and easing communication among technical staff.

The graphic solution by records (a spread in the printed version) came naturally in order to show in the most simple and schematic way the various subjects. The work had to have a synthetic and essential look. The importance of the technical drawings required a whole page for each subject, so the other page was dedicated to the text. This unusual arrangement was of great importance for the  $\LaTeX$  structure and for the very management of the editing work.

AG had significant experience as the editor of Colombo's handbook with about one hundred and fifty collaborators, so he had no difficulty finding the forty plus collaborators for the Quick Reference. The difficulty was in the coordination and the choice of what to write in this Quick Reference and in which detailed form to write it in the records. A general idea of the text length was given to the authors, but it was the editor's task to cut down lengthy contributions or to request some additional material for excessively short records.

To coordinate a few dozen authors is an interesting task, because authors are very different from one another from both the scientific and a human point of view. They range from the very precise and pedantic personality to the excessively ingenious and chaotic one. All of them, though, are very interested to see their experience take form and become a real printed object. Moreover, they were passionate about extracting a synthesis of their knowledge for the book. Many of them are true professionals, but with little experience as technical writers. For these reasons the coordination task revealed itself as heavier than foreseen, but at the end the editor and the authors were very satisfied.

At the moment (2007) at the publishing house they are working on the third edition, whose publication should be around May 2008. At the beginning of 2007 the publishing house opened a new Internet site, <http://www.manualihoeppli.it/>, intended to give information on the various published handbooks, and to publish integrations and updates that users may freely download. This site contains several pages from the Quick Reference, since they

are evidently assumed to be both interesting and good general advertising on behalf of the Hoepli Publishing Company.

This third edition will contain few modifications, compared to the second one, the most relevant of which is an increase in size, so that it is possible to increase also the font size and the legibility.

## 10 Conclusion

The Quick Reference has been a wonderful occasion for both AG and CB to learn how to use to its best advantage such a powerful instrument as  $\LaTeX$ . The book received a well deserved success so that, as said before, a third edition is under way; it contains not only upgraded information, but also the correction of some remaining typos.

Today, to create a similar work, from the point of view of the typesetter, would be much simpler, when one considers that most operations that were necessary to 'invent' when the first edition was published, are now mostly available with the countless packages, produced in the past 10 years, that have extended  $\LaTeX$ 's functionality.

Today the available packages allow us to create the necessary macros in a more orderly way, but most important, in a well-documented manner [5]; they allow building up typesetting structures in a simpler way by means of high level user commands made available by the extension packages: the graphic formats can be chosen more easily by means of the `geometry` package [8]; fonts can be chosen and configured with one statement, for example using the extended Times fonts [7], or the extended Palatino ones [6]; the style of titles and running titles can be defined with high level user commands [4]; the same is true for headers and footers [9]; even the handling of figure sets does not require the manual graphic editing as previously described [1].

Nevertheless all these packages, although extremely useful, if used by amateurs allow the creation of graphic designs that are not the best one can achieve.

Luckily, in this work the interaction between the  $\LaTeX$  programmer and those giving the design specification had a particular positive synergy. This type of collaboration allowed setting reasonable limits to the graphic novelty involved, thanks to both the experience of AG and the interaction with CB who could indicate what was and was not feasible with  $\LaTeX$  and the typesetting interpreter  $\TeX$ .

Thanks to this cooperation between the editors, specifying unrealizable requirements for the graphic design and the page layout was avoided. In truth, even though  $\LaTeX$  and  $\TeX$  are extremely powerful,



they are computer programs that operate in batch mode, not interactively. This is their strength and their weakness, since they are not (yet) at the level of the modern interactive pagination programs mostly used by publishing companies, but are far superior in typesetting paragraphs and mathematical expressions.

## References

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- [6] Young Ryu. *The PX fonts*, 2000. Normally distributed with the T<sub>E</sub>X system, documentation in file `doc/fonts/pxfonts/pxfontsdocA4.pdf`.
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