Word to \LaTeX{} for a Large, Multi-Author Scientific Paper

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Abstract

Numerous co-authors from diverse locations submitted to a scientific journal a manuscript for large review article in many sections, each formatted in MS Word. Journal policy for reviews, which attract no page charges, required a translation to \LaTeX{}, including the transformation of section-based references to a non-repetitive article-based list. Saving Word files in RTF format and using \texttt{rtf2latex2e} accomplished the basic translation, and then a \texttt{perl} program was used to get the references into acceptable condition. This approach to conversion succeeded and may be useful to others.

1 Introduction

Twelve authors from five countries and ten research institutions proposed to the \textit{Nuclear Fusion} journal \textit{(NF)} of the International Atomic Energy Agency (IAEA) in Vienna, Austria, a review paper with six sections plus a glossary.

This unusually large manuscript had some hundred thousand words and a thousand references. The sections had different lead authors, so that the references of each section were independent of those in other sections, while often repetitive among sections.

The IAEA gave review papers the privilege of waived publication charges ($150/page), but required authors to ease the publisher’s costs by submitting
manuscripts of reviews in $\LaTeX$, the journal’s typesetting system. Therefore, a considerable financial incentive appeared for finding a somewhat automated transformation of all the Word sources into a unified $\LaTeX$ source.

I was the editor of IAEA’s $NF$ from mid-1996 to mid-2002 with primary responsibility for the refereeing system and the development of the journal. Previous experience in Unix and $\LaTeX$ for my own research brought an unofficial role as adviser to the IAEA production office on shell scripts, $\LaTeX$, regular expressions, perl, and web mounting.

Since the paper appeared valuable from the point of view of journal development, and at the same time a challenge in computer processing, I became particularly interested, and encouraged the authors find ways to satisfy the IAEA requirement: a $\LaTeX$ manuscript to better support refereeing and eventual publication.

In the end, the paper in question [1] was published in $NF$ and was very well received by the research community, at great credit to the co-authors and also good for $NF$.

When the recent call for papers at PracTex came in it occurred to me that the story might be interesting for this audience.

## 2 Translation from Word to $\LaTeX$

At the time of submission (mid-1999) the IAEA and $NF$ had investigated with a consultant conversions from Word to $\LaTeX$, but had not found a satisfactory solution. One of the twelve authors suggested “rtf2latex2e” by Ujwal Setlur Sathyam (now Ujwal Setlur) and Scott Prahl, following the Word-native RTF (Rich Text Format) writer.

Here is Microsoft’s description of RTF from msdn.microsoft.com,

“The Rich Text Format (RTF) Specification provides a format for text and graphics interchange that can be used with different output devices, operating environments, and operating systems. RTF uses the ANSI, PC-8, Macintosh, or IBM PC character set to control the representation and formatting of a document, both on the screen and in print. With the RTF Specification, documents created under different operating systems and with different software applications can be transferred between those operating systems and applications.”

rtf2latex2e uses the RTF reader by Paul DuBois and converts RTF files to $\LaTeX2e$. Some features are: detects text style (bold, italic, etc.); reads embedded
figures; reads tables; converts embedded MathType; converts most Greek and
math symbols; reads footnotes; translates hyperlinks. It should compile on any
platform that supports a C compiler. Versions for Macintosh, Unix-type systems,
and Windows are available. The distribution, issued under the terms of the GNU
General Public License as published by the Free Software Foundation, comes with
example .rtf files.

The current, and final, version of rtf2latex2e can be found on the Comprehen-
sive \LaTeX{} Archive Network, ctan.org/tex-archive/support/rtf2latex2e and at
sourceforge.net.

The result of translation gave the expected
\documentclass{article}
\begin{document}
\section*{1. INTRODUCTION}

and looked good regarding mathematics and tables, but left all citations as foot-
notes with the expected chaos with repeated references. A typical reference (of the
thousands) appeared many times with different chapter-based numbers.

The footnotes were rendered, for example, as [1.\footnote{[1.] Author, A.,
Some Journal \textbf{36} (1997) 123.}] in section 1, but in generally the same
way in section 2, except that the “[1.]” became “[2.]”.

One task is to transform the \footnote{style that survives after the Word-rtf-
\LaTeX{} transformation into the normal \cite{...}-\bibitem{...} representation
of references. More complicated is to detect as identical those references to the
same work presented with slight differences; and to detect as distinct those refer-
ences that are actually different but “look” similar.

The goal was a unique citation in the body, such as \cite{AuthorA36p123},
and a corresponding entry in the bibliography, such as \bibitem{AuthorA36p123}

The power of “perl” (Practical Extraction and Reporting Language) and its
version of “regular expressions” made order from chaos, and produced material
suitable for refereeing, and, eventually, publication.

\section{A Sketch of the Process}

A “regular expression” (regex) is a generalized string for matching patterns, and
possibly replacing whatever is found found with something else. The programs
grep (Global Regular Expression Printer) sed (Stream EDitor) and the text editor emacs, all of which are part of Unix-like systems, incorporate regex-es.¹

The compositors at NF had the following problem, which was tamed with regular expressions in emacs. Journal style treated the names of authors in references as “A.B. Smith” but manuscripts often arrived with treatments such as “SMITH, A. B.” or “Smith, A.B.” or “A. B. SMITH.” Making changes by hand was obviously prone to error, not to mention laborious for those papers needing dozens to hundreds of changes. A little experimentation with a couple keyboard macros on my part greatly simplified a frustrating chore in typesetting.

What follows is a description of regex and perl. If you like, you may skip to section 4.

For a flavor of the regex world from the programming point of view:

```
/s/Old/New/g : Old → New globally (g)
/s/^Old/New/ : Old → New at line start (^)
/s/(...)Old/NEW\1/ : xyxOld → NEWxyz
```

In the last example, the string Old is sought, but only if it preceded on its line by 3 characters, which are to be remembered by the parentheses ( ) with the label \1. Then, Old is to be replaced by NEW but followed by the 3 characters just found (here called xyz).

These examples only suggest the full power of searching and replacing available, in particular with perl.

A short summary of the regex usages is in “Linux in a Nutshell” [2], and an excellent introduction is in the Wikipedia [3].


The lead author of Ref. 1, Gianfranco Federici, contacted a colleague, Andreas Schott, about the challenge of rationalizing the references. Schott produced a perl script foot2cite.pl which accomplished the task.

A few years previously the NF Office had developed a collection of bash [9] shell and perl scripts to produce print masters and files for mounting pdf and

¹The tools mentioned above had versions workable under Windows 95, but comments on the capability of later Windows and Macintosh systems are outside the scope of this document.
html [10] articles on the IAEA web server. The \LaTeX{} source of individual articles led to tables of contents and indexes of authors and subjects from individual article source files with the help of native \LaTeX{} markup plus additional markup commands of the local style file. From that experience\textsuperscript{2} it appeared interesting to develop an IAEA-local program which could be the base of solutions that might be needed in the future.

Perhaps some readers have heard of the humorous comment that the term \texttt{perl} might have at one time been an acronym for “Particularly Eclectic Rubbish Lister.” Certainly a casual glance at a \texttt{perl} script can scare off even people with some programming experience, especially experience in Fortran. All those odd backslashes changing the meaning of all characters; all those single letters meaning complex and subtle manipulations! It does appear daunting.

One point of this paper is that some significant goals can be accomplished by a \texttt{perl} novice after reading through the Llama book [7], putting a compact summary [8] in ones “lap,” and trying things, one line at a time. Even a description of the strategy (suppressing details of the compact syntax) can slow down the average reader, so I choose, with the advice of the PracTeX Editor, to move on to the results of the scripting process.

For those interested, some features of the resulting \texttt{ref\_manip.pl} are described in the following section 5.

\section{The Result}

The processing into \LaTeX{} of the first draft manuscript created one format completely common to all contributing institutions and authors. With that common form, adjustments in response to the concerns of the NF editorial office and referees became easier, as did changes originating with the paper’s authors as the review developed. Even so, the refereeing process was extensive, which is not uncommon for articles appearing in NF, and particularly articles of such a length.

Independent of what the authors of Ref. 1 feel about their article and the process of publishing it, the publishing journal and its home organization have interests.

\textsuperscript{2}The utility of combining \LaTeX{} with scripting languages has been explored recently for the TUG; see for example William M. Richter, “\TeX{} and Scripting Languages” TUGboat, Vol 25, No. 1, p 71 (2004).
The Institute for Scientific Information (ISI) keeps track of an “Impact Factor” (IF) for thousands of journals [11]. The IF is (at least approximately) the number of citations to a journal divided by the number of articles in the period studied. *Nature* and *Science* have IFs in the 20–30 range. The very prestigious *Physical Review Letters* has an IF around 6, and the *Physical Review*, (series A, B, C, D, and E) is typically between 2 and 3. Journals covering plasma physics and nuclear fusion range from 0.5 to 3 or so, and *NF* is consistently the highest in the group. In the six years ending in 2003 *NF* was between 2.2 and 3.4.

According to Google’s newly introduced “Scholar” service, articles from all journals covered referenced Ref. 1 23 times, which is unusually high for the sub-field of science and engineering covered by *NF*. (The time frame was not apparent from the information at Google.)

Records available at the IAEA show that for Ref. 1 there were 162 downloads in 2003, placing it number 7 in the top 10 downloads for that year; and that the citation rate is roughly double the next most cited article, and far above the average rate.

The numbers quoted above suggest that the research community received Ref. 1 unusually well, making it a fine credit to each of the authors and to their institutions. The numbers also say that the article had significant positive influence on the IF of *NF*, and therefore a positive influence on the continued success of *NF*. In other words, the appearance of this article was very good for its authors as well as the IAEA and *NF*.

Remembering that publication in *NF*, and at low cost to submitters, required a \LaTeX manuscript, one can wonder if all the good news would have happened without \texttt{rtf2latex2e} and \texttt{perl}. My speculation:

1. the research paper would have come out, if at all, later than it did,
2. it would not have appeared in *NF*,
3. the authors would not have gotten quite the recognition they did,
4. the IAEA and its journal would have a lower IF for the relevant period.

### 5 Some Details on Rationalizing the References

The idea was to use the “hash” facility in \texttt{perl}. Here, a hash is a 1-dimensional array in which the index and the value of the index are both character strings.
The 1-to-1 hash `num2cite` connected the Word-original reference number, such as “1.101,” to a string designed to be unique (except in pathological circumstances) such as “AuthorA36p123.” For diagnostic purposes the 1-to-1-or-more hash `cite2nums` connected the (uniquely created) `\cite` and `\bibitem` string such as “AuthorA36p123” to the (multiple, in general) original reference numbers such as “1.101”; “2.45”.

The multiple \LaTeX section files produced by `rtf2latex2e` are scanned in sequence for a footnote. If footnote-style text of the nature author-journal-volume-page is found, then an identifier string is made of the first author’s last name, first initial, volume number, page number (AuthorA36p123). The text of the reference is entered in a holder for the bibliography under `\bibitem{AuthorA36p123}`, while the footnote is replaced by `\cite{AuthorA36p123}`. Next, the two hashes receive the appropriate entries — such as “1.101” and “AuthorA36p12” — with the help of a counter in the \perl script. That counter should not become out of synchronization with the footnote numbers given in the paper unless there is is a mistake in the original text.

The references not citing journal articles are detected by the absence of a bolding of an alphanumeric volume number in a footnote. In that case, the `cite` and `bibitem` identifier is formed from the first twenty alpha-numeric characters in the citation, excluding all white space. Again, the text of the reference goes to the bibliography as a `\bibitem`.

If the footnote is to a previously used number, such as [1.101] or [2.202], then the `num2cite` hash is used to enter the citation with the `\cite` format, without adding anything to the bibliography.

In the script as developed, pre-processing of the raw section files does, for example, the following:

- takes out explicit section numbering
- makes all citations (recall, they are of the `\footnote` type) begin in column one as `\CITE[...]` and occupy one entire (sometimes very long) line
- makes the bolded volume numbers into a particular form that will not confuse later searches for a right brace closing the footnote.

That pre-processing is no doubt a sign of ignorance of the full power of \perl, and no doubt extends the execution time. However, execution time is not a practical issue, but being able to construct the script in small pieces that do small, easily
testable, things was very much an issue in the environment of the NF editorial and production offices.

The final pass changes `\cite[...]{...}` into `\cite{...}`, writes the `\bibitem{...}` entries, and, optionally, saves the hashes `num2cite` and `cite2nums` for diagnostics.

There are vulnerabilities. A simple one, which could be programmed around, is that the original footnotes cannot contain inside them the characters `[ ]` or, other than for volume bolding, `{}`. A more difficult vulnerability, practically speaking inevitable, is that truly identical references have to be presented in pretty much the same way. There is probably no automated way to defend against typographical errors in the names, volume or page numbers. (The potential vulnerability to different amounts of white space had a simple defense.) However, an off-line sort of all the `\cite` and `\bibitem` texts would have a good chance of revealing a problem.

6 Acknowledgments

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In January 2002, the Institute of Physics Publishing (IoPP) of Bristol, UK, assumed responsibility for production (again, based on `\LaTeX`) while the IAEA editorial office, located in Vienna, Austria, continued to manage content. The Federici paper [1] is now mounted on the web by the IoPP. The present editor of `NF` is F.C. Schüller of The Netherlands.

David Walden contributed helpful comments on a preliminary draft of this paper. Editor Lance Carnes suggested some rearrangements to increase accessibility.
References


