

Data Enhancements in a Digital Mathematical Library

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Goals of a Digital Library

- The quality of digital mathematical library depends on the quality of data it offers.
- The viability of a digital library rests with new acquisitions emerging mainly in the form of born-digital publications.
- It is important to
 - provide data as soon as possible,
 - in a digital-use-friendly format,
 - and exactly matching printed originals.

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 - a lightweight XML metadata extraction system for mathematical journal editors,
 - a proof of concept of a method that improves usability of mathematical PDF documents.

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 - a lightweight XML metadata extraction system for mathematical journal editors,
 - a proof of concept of a method that improves usability of mathematical PDF documents.

Need for a Lightweight XML Metadata Extraction System

- It has been necessary to prepare appropriate software support for the mathematical journals involved in the DML-CZ project that will enable editors to prepare born-digital data easily.
- Main idea: born-digital data acquisition as a by-product of publishing printed version of the journal.
- The first approach was a complex system inspired by the French CEDRAM project.
- Sometimes the complex journal processing system is too complex.
 - Great interference with the current workflow of the editor.
 - Not all the editors use (and are ready to use) \LaTeX .
 - Not all the editors use (and are ready to use) Bib \TeX .
- A simple, universal and flexible solution was needed.

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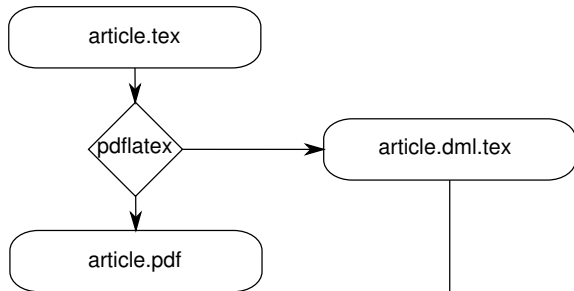
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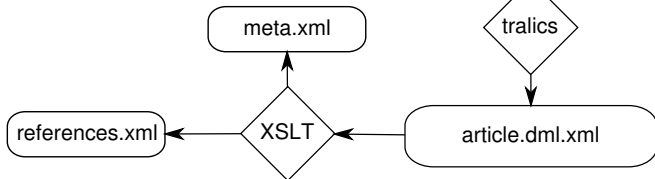
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Article processing



Metadata extraction



How Does It Work

- A lightweight set of \LaTeX macros in the form of a \LaTeX macro package.
 - Can be easily customized to meet needs of a particular journal document class / style file.
 - The \LaTeX macro package itself does not transform the \LaTeX source code to XML.
 - Literally exports selected parts of the \LaTeX document to an external file.
 - This file is subsequently processed by a journal-independent Tralics-based procedure.

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How Does It Work (cont.)

```
\documentclass[runningheads]{llncs}
\usepackage{dmlcommon}
\usepackage{dmlcz}

\begin{document}

\author{Petr Sojka}
\dmlaindex{Sojka}{Petr}
\dmltitle{Towards a Digital Mathematical Library}
...
\maketitle

\begin{dmlabstract}
The workshop's objectives were to formulate the strategy
and goals of a global mathematical digital library...
\end{dmlabstract}
...
```


How Does It Work (cont.)

```
\documentclass{dmlczmeta}\begin{document}

\begin{xmlelement}{author}{Sojka, Petr
\XMLaddatt{order}{1}}\end{xmlelement}

\begin{xmlelement}{title}{Towards a Digital Mathematical
Library\XMLaddatt{lang}{eng}}\end{xmlelement}

\begin{xmlelement}{abstract}\XMLaddatt{lang}{eng}\bgroup
The workshop's objectives were to formulate the strategy
and goals of a global mathematical digital library...
\egroup\end{xmlelement}

\begin{xmlelement}{keyword}{OCR\XMLaddatt{lang}{eng}}
\end{xmlelement}

...
\end{document}
```

How Does It Work (cont.)

- Tralics is a \LaTeX to XML translator.
 - The most indispensable part of the system.
 - Its engine is able to process regular \LaTeX code.
 - It is not necessary to
 - convert the \LaTeX code to plain text directly,
 - nor deal with the \LaTeX macro expansion or the complexity of its syntax.
- Tralics outputs a UTF-8 encoded XML file.
- This output is finally processed by the XLST processor furnishing DML-CZ metadata in its final form.

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How Does It Work (cont.)

```

<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE std SYSTEM 'classes.dtd'>
<!-- Translated from latex by tralics 2.13.5,
      date: 2010/07/03-->
<std><p>
<author order='1'>Sojka, Petr</author>
<title lang='eng'>Towards a Digital Mathematical
Library</title>

<abstract lang='eng'>The workshop's objectives were to
formulate the strategy...</abstract>
<keyword lang='eng'>OCR</keyword>
<keyword lang='eng'>OpenMath</keyword>

<language>eng</language>
<abstractlanguage>eng</abstractlanguage>
...
</p></std>

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Why It Is Useful

- It is easy to integrate this procedure to an existing journal processing workflow. It is thus acceptable to all the involved editors.
 - Current T_EX processing is used.
 - Platform independent.
 - The T_EX itself produces the source file.
 - XML generated using Tralics and XSLT.
 - No need for BibT_EX.
- It is safe.
 - At the same time as the final PDF document is created, the metadata is automatically generated based on the same source code.
- Since Tralics supports MathML we are able to translate mathematical expressions from the input L^AT_EX notation to this XML language.

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- L^AT_EX mathematical notation is well known and effective.
 - Used not only in L^AT_EX documents, but also in a variety of other projects, such as Wikipedia.
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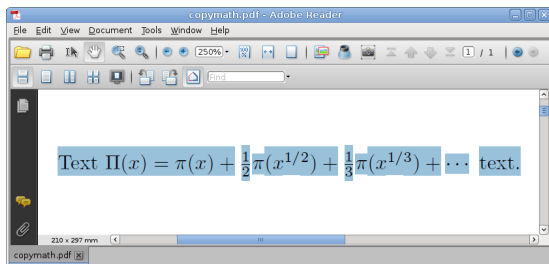
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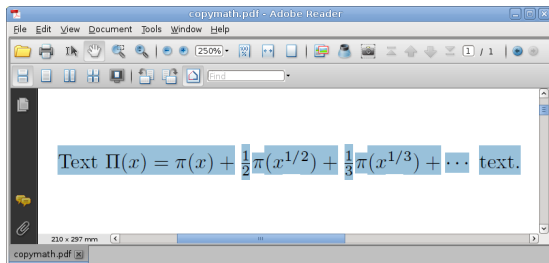
Standard PDF document



\LaTeX source code:

```
Text $\Pi(x) = \pi(x) +
\frac{1}{2}\pi(x^{1/2}) +
\frac{1}{3}\pi(x^{1/3}) + \cdots$
text.
```

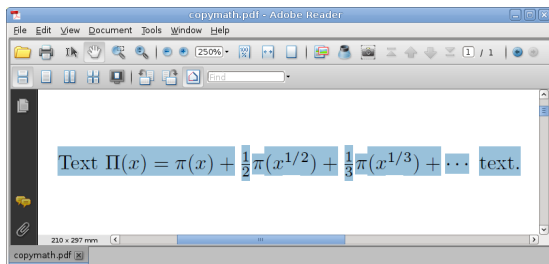
Standard PDF document



PDF code:

```
BT
/F16 9.9626 Tf 148.712 707.125 Td [(T)83(ext)]TJ/F17 9.9626 Tf 23.247 0 Td
[(\005\050)]TJ/F20 9.9626 Tf 11.346 0 Td [(x)]TJ/F17 9.9626 Tf 5.694 0 Td
[(\051)-278(=)]TJ/F20 9.9626 Tf 17.158 0 Td [(031)]TJ/F17 9.9626 Tf 6.036 0 Td
[(\050)]TJ/F20 9.9626 Tf 3.875 0 Td [(x)]TJ/F17 9.9626 Tf 5.694 0 Td
[(\051)-222(+)]TJ/F18 6.9738 Tf 17.247 3.923 Td [(1)]TJ
ET
```

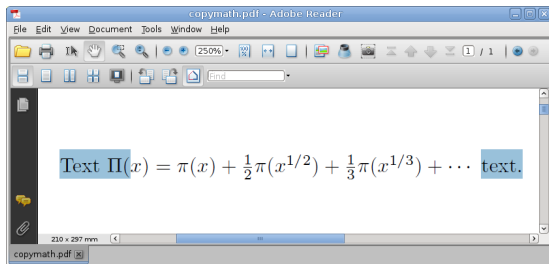
Standard PDF document



Text obtained using Copy & Paste function of PDF reader:

Text () = () + 1
 2 (1/2) + 1
 3 (1/3) + · · · text.

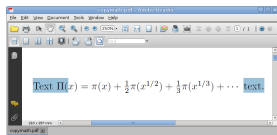
CopyMath-enabled PDF document



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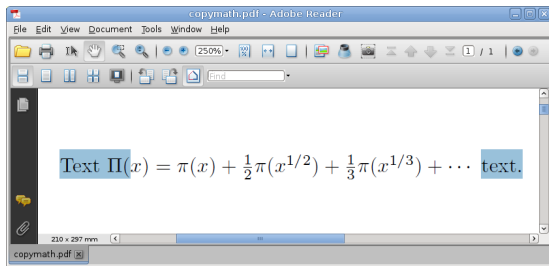
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PDF code:

```
BT
/F16 9.9626 Tf 148.712 707.125 Td [(T)83(ext)]TJ
ET
1 0 0 1 171.959 707.125 cm
/Span <<
/ActualText<245C506920287829203D205C706920287829202B205C66726163207B317D7B32
7D5C70692028785E7B312F327D29202B205C66726163207B317D7B337D5C70692028785E7B31
2F337D29202B205C63646F74732024> >> BDC
1 0 0 1 -171.959 -707.125 cm
BT
/F17 9.9626 Tf 171.959 707.125 Td [(\005\050)]TJ/F20 9.9626 Tf 11.346 0 Td
[(x)]TJ/F17 9.9626 Tf 5.694 0 Td [(\051)-278(=)]TJ/F20 9.9626 Tf 17.158 0 Td
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Td [(1)]TJ
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Implementation

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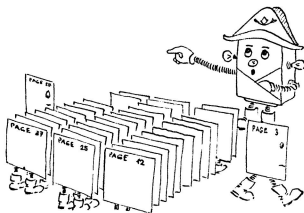
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Questions?





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