

The sTeX3 Package Collection *

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2022-09-27

Abstract

sTeX is a collection of L^AT_EX packages that allow to markup documents semantically without leaving the document format.

Running ‘pdflatex’ over sTeX-annotated documents formats them into normal-looking PDF. But sTeX also comes with a conversion pipeline into semantically annotated HTML5, which can host semantic added-value services that make the documents active (i.e. interactive and user-adaptive) and essentially turning L^AT_EX into a document format for (mathematical) knowledge management (MKM).

sTeX augments L^AT_EX with

- *semantic macros* that denote and distinguish between mathematical concepts, operators, etc. independent of their notational presentation,
- a powerful *module system* that allows for authoring and importing individual fragments containing document text and/or semantic macros, independent of – and without hard coding – directory paths relative to the current document, and
- a mechanism for exporting sTeX documents to (modular) XHTML, preserving all the semantic information for semantically informed knowledge management services.

This is the full documentation of sTeX. It consists of four parts:

- **Part I** is a general manual for the sTeX package and associated software. It is primarily directed at end-users who want to use sTeX to author semantically enriched documents.
- **Part II** documents the macros provided by the sTeX package. It is primarily directed at package authors who want to build on sTeX, but can also serve as a reference manual for end-users.
- **Part III** documents additional packages that build on sTeX, primarily its module system. These are not part of the sTeX package itself, but useful additions enabled by sTeX package functionality.
- **Part IV** is the detailed documentation of the sTeX package implementation.

*Version 3.2 (last revised 2022-09-27)

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Part I

Manual



Boxes like this one contain implementation details that are mostly relevant for more advanced use cases, might be useful to know when debugging, or might be good to know to better understand how something works. They can easily be skipped on a first read.



Boxes like this one explain how some `TeX` concept relates to the MMT/OMDoc system, philosophy or language; see [MMT; Koh06] for introductions.

Chapter 1

What is sTeX?

Formal systems for mathematics (such as interactive theorem provers) have the potential to significantly increase both the accessibility of published knowledge, as well as the confidence in its veracity, by rendering the precise semantics of statements machine actionable. This allows for a plurality of added-value services, from semantic search up to verification and automated theorem proving. Unfortunately, their usefulness is hidden behind severe barriers to accessibility; primarily related to their surface languages reminiscent of programming languages and very unlike informal standards of presentation.

sTeX minimizes this gap between informal and formal mathematics by integrating formal methods into established and widespread authoring workflows, primarily L^AT_EX, via non-intrusive semantic annotations of arbitrary informal document fragments. That way formal knowledge management services become available for informal documents, accessible via an IDE for authors and via generated *active* documents for readers, while remaining fully compatible with existing authoring workflows and publishing systems.

Additionally, an extensible library of reusable document fragments is being developed, that serve as reference targets for global disambiguation, intermediaries for content exchange between systems and other services.

Every component of the system is designed modularly and extensibly, and thus lay the groundwork for a potential full integration of interactive theorem proving systems into established informal document authoring workflows.

The general sTeX workflow combines functionalities provided by several pieces of software:

- The sTeX package collection to use semantic annotations in L^AT_EX documents,
- RuS_{TeX} [RT] to convert `tex` sources to (semantically enriched) `xhtml`,
- The MMT system [MMT], that extracts semantic information from the thus generated `xhtml` and provides semantically informed added value services. Notably, MMT integrates the RuS_{TeX} system already.

Chapter 2

Setup

There are two ways of using sTeX : as a

1. way of writing \LaTeX more modularly (object-oriented Math) for creating PDF documents or
2. foundation for authoring active documents in HTML5 instrumented with knowledge management services.

Both are legitimate and useful. The first requires a significantly smaller tool-chain, so we describe it first. The second requires a much more substantial toolchain of knowledge management systems.

Luckily, the sTeX -IDE will take care of much of the setup required for the full toolchain, if you are willing to use it.

2.1 Setting up the sTeX Package

2.1.1 Minimal Setup for the sTeX Package

In the best of all worlds, there is no setup, as you already have a new version of \TeX Live on your system as a \LaTeX enthusiast. If not now is the time to install it; see [TL]. You can usually update \TeX Live via a package manager or the \TeX Live manager **tlmgr**. sTeX requires a \TeX kernel newer than February 2022.

Alternatively, you can install sTeX from CTAN, the Comprehensive \TeX Archive Network; see [ST] for details. We assume you have the sTeX package in at least version 3.2 (September 2022).

2.1.2 GIT-based Setup for the sTeX Development Version

If you want use the latest and greatest sTeX packages that have not even been released to CTAN, then you can directly clone them from the sTeX development repository [sTeX] by the following command-line instructions:

```
cd <stexdir>
git clone https://github.com/slatex/sTeX.git
```

and keep it updated by pulling updates via `git pull` in the cloned sTeX directory. Make sure to either clone the sTeX repository into a local `texmf-tree` or to update your `TEXINPUTS` environment variable, e.g. by placing the following line in your `.bashrc`:

```
export TEXINPUTS="$(TEXINPUTS):<sTeXDIR>//:"
```

2.1.3 Setting your MathHub Directory

One of sTeX’s features is a proper *module system* of interconnected document snippets for mathematical content. Analogously to *object-oriented programming*, it allows for “object-oriented mathematics” via individual combinable and, importantly, *reusable* modules, developed collaboratively.

To make use of such modules, the sTeX system needs to be told where to find them. There are several ways to do so (see [subsection 5.2.1](#)), but the most convenient way to do so is via a system variable.

To do so, create a directory **MathHub** somewhere on your local file system and set the environment variable **MATHHUB** to the file path to that directory.

In linux, you can do so by writing

```
export MATHHUB="/path/to/your/MathHub"
```

in your `~/.profile` (for all shells) or `~/.bashrc` (for the bash terminal only) file.

2.2 Setting up the sTeX IDE

The sTeX IDE consists of two components using the *Language Server Protocol (LSP)*: A *client* in the form of a VSCode extension, and a *server* included in the MMT system. Installing the extension will open up a setup routine that will guide you through the rest.

2.2.1 The sTeX VSCode Extension

If you have not already, you should first install the VSCode editor available at <https://code.visualstudio.com/>.

Next, open VSCode and install the sTeX extension by clicking on the *extensions* menu on the very left of the VSCode window and searching for “sTeX” in the “*Search Extensions in Marketplace*” field, as in [Figure 1](#), and clicking the *Install*-button of the sTeX extension by KWARC.

2.2.2 Setting up Mmt

Next, open any directory (**File** → **Open Folder...**) that contains a `.tex`-file, and a setup window as in [Figure 2](#) will pop up. Click on the highlighted link ‘*here*’ and download the latest version of the `MMT.jar` file (at least version 23.0.0) anywhere you like. Then click the “*Browse...*”-button and select your freshly downloaded `MMT.jar`.

If you have already set a system variable for your MathHub-directory, you are now done and can click “*Finish*”. If you have not, you can now also enter a directory path in the lower text field, and the VSCode extension will attempt to globally set one up for you, depending on your operating system.

Once you click “*Finish*”, the client will connect to <https://stexmmt.mathhub.info/:sTeX>, query for available archives, download the core libraries required for all (or most) semantic services (MMT/urtheories and sTeX/meta-inf) and set up RuSTeX for you automatically.

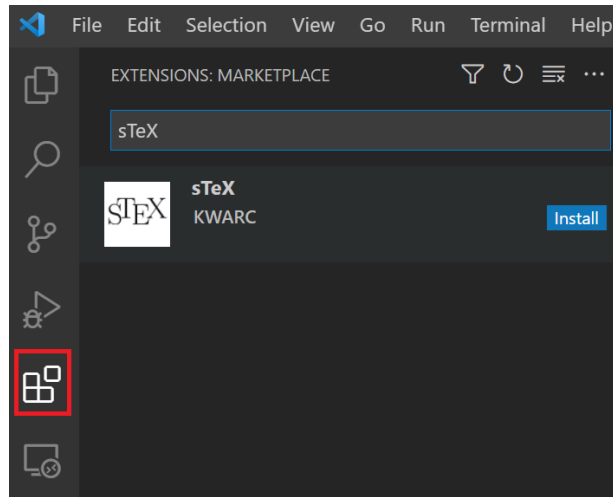


Figure 1: Installing the sTeX extension for VSCode

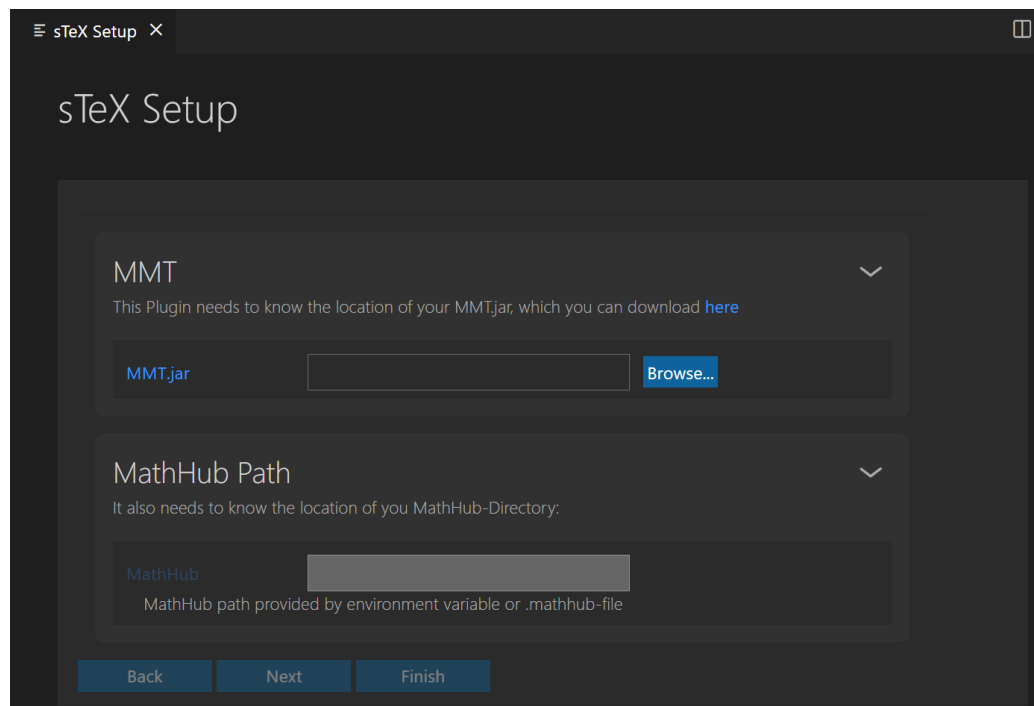


Figure 2: sTeX Setup Routine

2.3 Manual Setup

In lieu of using the $\text{\S}\text{\TeX}$ IDE, we can do the following:

2.3.1 $\text{\S}\text{\TeX}$ Archives (Manual Setup)

Writing semantically annotated $\text{\S}\text{\TeX}$ becomes much easier, if we can use well-designed libraries of already annotated content. $\text{\S}\text{\TeX}$ provides such libraries as $\text{\S}\text{\TeX}$ archives – i.e. GIT repositories at <https://gl.mathhub.info> – most prominently the SMGLoM libraries at <https://gl.mathhub.info/smgglom>.

To do so, we set up a **local MathHub** by creating a MathHub directory `<mhdir>`. Every $\text{\S}\text{\TeX}$ archive as an **archive path** `<apath>` and a name `<archive>`. We can clone the $\text{\S}\text{\TeX}$ archive by the following command-line instructions:

```
cd <mhdir>/<apath>
git clone https://gl.mathhub.info/smgglom/<archive>.git
```

Note that $\text{\S}\text{\TeX}$ archives often depend on other archives, thus you should be prepared to clone these as well – e.g. if `pdflatex` reports missing files. To make sure that $\text{\S}\text{\TeX}$ too knows where to find its archives, we need to set a global system variable `MATHHUB`, that points to your local MathHub-directory (see [section 5.2](#)).

```
export MATHHUB="<mhdir>"
```

2.3.2 Manual Setup for Active Documents and Knowledge Management Services

Foregoing on the $\text{\S}\text{\TeX}$ IDE, we will need several additional (on top of the minimal setup above) pieces of software; namely:

- **The Mmt System** available [here](#). We recommend following the setup routine documented [here](#).

Following the setup routine (Step 3) will entail designating a **MathHub**-directory on your local file system, where the MMT system will look for $\text{\S}\text{\TeX}$ /MMT content archives.

- **$\text{\S}\text{\TeX}$ Archives** If we only care about \LaTeX and generating `pdfs`, we do not technically need MMT at all; however, we still need the `MATHHUB` system variable to be set. Furthermore, MMT can make downloading content archives we might want to use significantly easier, since it makes sure that all dependencies of (often highly interrelated) $\text{\S}\text{\TeX}$ archives are cloned as well.

Once set up, we can run `mmt` in a shell and download an archive along with all of its dependencies like this: `lmh install <name-of-repository>`, or a whole *group* of archives; for example, `lmh install smgglom` will download all `smgglom` archives.

- **$\text{R}_{\text{\S}\text{\TeX}}$** The MMT system will also set up $\text{R}_{\text{\S}\text{\TeX}}$ for you, which is used to generate (semantically annotated) `xhtml` from `tex` sources. In lieu of using MMT, you can also download and use $\text{R}_{\text{\S}\text{\TeX}}$ directly [here](#).

Chapter 3

The \TeX IDE

Chapter 4

A First sTeX Document

Having set everything up, we can write a first sTeX document. As an example, we will use the smglom/calculus and smglom/arithmetics archives, which should be present in the designated MathHub-folder, and write a small fragment defining the *geometric series*:

```
1 \documentclass{article}
2 \usepackage{stex,xcolor,stexthm}
3
4 \begin{document}
5 \begin{smodule}{GeometricSeries}
6   \importmodule[smglom/calculus]{series}
7   \importmodule[smglom/arithmetics]{realarith}
8
9   \symdef{geometricSeries}[name=geometric-series]{\comp{S}}
10
11   \begin{sdefinition}[for=geometricSeries]
12     The \define{geometricSeries} is the \symname{series}
13     \[\defeq{\geometricSeries}{\definiens{
14       \infinitesum{\svar{n}}{1}{
15         \realdivide[frac]{1}{
16           \realpower{2}{\svar{n}}
17         }
18       }}.\]
```

Compiling this document with pdf_lat_ex should yield the output

Definition 0.1. The **geometric series** is the **series**

$$S := \sum_{n=1}^{\infty} \frac{1}{2^n}.$$

Theorem 0.2. The [geometric series converges](#) towards 1.

Move your cursor over the various highlighted parts of the document – depending on your pdf viewer, this should yield some interesting (but possibly for now cryptic) information.

Remark 4.0.1:

Note that all of the highlighting, tooltips, coloring and the environment headers come from `stexthm` – by default, the amount of additional packages loaded is kept to a minimum and all the presentations can be customized, see [section 7.3](#).

Let’s investigate this document in detail to understand the respective parts of the \TeX markup infrastructure:

```
smodule (env.) \begin{smodule}{GeometricSeries}
...
\end{smodule}
```

First, we open a new *module* called `GeometricSeries`. The main purpose of the `smodule` environment is to group the contents and associate it with a *globally unique* identifier (URI), which is computed from the name `GeometricSeries` and the document context.

(Depending on your pdf viewer), the URI should pop up in a tooltip if you hover over the word [geometric series](#).

```
\importmodule \importmodule[smglom/calculus]{series}
\importmodule \importmodule[smglom/arithmetics]{realarith}
```

Next, we *import* two modules – `series` from the \TeX archive `smglom/calculus`, and `realarith` from the \TeX archive `smglom/arithmetics`. If we investigate these archives, we find the files `series.en.tex` and `realarith.en.tex` (respectively) in their respective source-folders, which contain the statements `\begin{smodule}{series}` and `\begin{smodule}{realarith}` (respectively).

The `\importmodule`-statements make all \TeX symbols and associated semantic macros (e.g. `\infinitesum`, `\realdive`, `\realpower`) in the imported module available to the current module `GeometricSeries`. The module `GeometricSeries` “exports” all of these symbols to all modules imports it via an `\importmodule{GeometricSeries}` instruction. Additionally it exports the local symbol `\geometricSeries`.

```
\usemodule
```

If we only want to *use* the content of some module `Foo`, e.g. in remarks or examples, but none of the symbols in our current module actually *depend* on the content of `Foo`, we can use `\usemodule` instead – like `\importmodule`, this will make the module content available, but will *not* export it to other modules.

```
\symdef \symdef{GeometricSeries}[name=geometric-series]{\comp{S}}
```

Next, we introduce a new *symbol* with name `geometric-series` and assign it the semantic macro `\geometricSeries`. `\symdef` also immediately assigns this symbol a *notation*, namely `S`.

\comp The macro `\comp` marks the S in the notation as a *notational component*, as opposed to e.g. arguments to `\geometricSeries`. It is the notational components that get highlighted and associated with the corresponding symbol (i.e. in this case `\geometricSeries`). Since `\geometricSeries` takes no arguments, we can wrap the whole notation in a `\comp`.

```
\begin{sdefinition}[for=geometricSeries]
...
\end{sdefinition}
\begin{sassertion}[name=geometricSeriesConverges,type=theorem]
...
\end{sassertion}
```

What follows are two \LaTeX -statements (e.g. definitions, theorems, examples, proofs, ...). These are semantically marked-up variants of the usual environments, which take additional optional arguments (e.g. `for=`, `type=`, `name=`). Since many \LaTeX templates predefine environments like `definition` or `theorem` with different syntax, we use `sdefinition`, `sassertion`, `sexample` etc. instead. You can customize these environments to e.g. simply wrap around some predefined `theorem`-environment. That way, we can still use `sassertion` to provide semantic information, while being fully compatible with (and using the document presentation of) predefined environments.

In our case, the `stexthm`-package patches e.g. `\begin{sassertion}[type=theorem]` to use a `theorem`-environment defined (as usual) using the `amsthm` package.

\symname ... is the `\symname{?series}`

The `\symname`-command prints the name of a symbol, highlights it (based on customizable settings) and associates the text printed with the corresponding symbol.

Note that the argument of `\symref` can be an imported symbol (here the `series` symbol is imported from the `series` module). \LaTeX tries to determine the full symbol URI from the argument. If there are name clashes in or with the imported symbols, the name of the exporting module can be prepended to the symbol name before the `?` character.

If you hover over the word `series` in the pdf output, you should see a tooltip showing the full URI of the symbol used.

\symref The `\symname`-command is a special case of the more general `\symref`-command, which allows customizing the precise text associated with a symbol. `\symref` takes two arguments: the first is the symbol name (or macro name), and the second a variant verbalization of the symbol, e.g. an inflection variant, a different language or a synonym. In our example `\symname{?series}` abbreviates `\symref{?series}{series}`.

\define The `\define{geometricSeries} ...`
\definiendum The `sdefinition`-environment provides two additional macros, `\define` and `\definiendum` which behave similarly to `\symname` and `\symref`, but explicitly mark the symbols as *being defined* in this environment, to allow for special highlighting.

```

\[\defeq{\geometricSeries}{\definiens{
  \infinitesum{\svar{n}}{1}{
    \realdivide[frac]{1}{
      \realpower{2}{\svar{n}}
    }
  }}
}\].\]

```

The next snippet – set in a math environment – uses several semantic macros imported from (or recursively via) `series` and `realarithmetics`, such as `\defeq`, `\infinitesum`, etc. In math mode, using a semantic macro inserts its (default) definition. A semantic macro can have several notations – in that case, we can explicitly choose a specific notation by providing its identifier as an optional argument; e.g. `\realdivide[frac]{a}{b}` will use the explicit notation named `frac` of the semantic macro `\realdivide`, which yields $\frac{a}{b}$ instead of a/b .

`\svar` The `\svar{n}` command marks up the `n` as a variable with name `n` and notation `n`.

`\definiens` The `sdefinition`-environment additionally provides the `\definiens`-command, which allows for explicitly marking up its argument as the *definiens* of the symbol currently being defined.

4.1 OMDoc/xhtml Conversion

So, if we run `pdflatex` on our document, then \TeX yields pretty colors and tooltips¹. But \TeX becomes a lot more powerful if we additionally convert our document to `xhtml` while preserving all the \TeX markup in the result.

TODO VSCode Plugin

Using `RuSTeX [RT]`, we can convert the document to `xhtml` using the command `rustex -i /path/to/file.tex -o /path/to/outfile.xhtml`. Investigating the resulting file, we notice additional semantic information resulting from our usage of semantic macros, `\symref` etc. Below is the (abbreviated) snippet inside our `\definiens` block:

```

<mrow resource="" property="stex:definiens">
  <mrow resource="...?series?infinitesum" property="stex:OMBIND">
    <munderover displaystyle="true">
      <mo resource="...?series?infinitesum" property="stex:comp">\Sigma</mo>
      <mrow>
        <mrow resource="1" property="stex:arg">
          <mi resource="var://n" property="stex:OMV">n</mi>
        </mrow>
        <mo resource="...?series?infinitesum" property="stex:comp">=</mo>
        <mi resource="2" property="stex:arg">1</mi>
      </mrow>
      <mi resource="...?series?infinitesum" property="stex:comp">\infty</mi>
    </munderover>
    <mrow resource="3" property="stex:arg">
      <mfrac resource="...?realarith?division#frac#" property="stex:OMA">
        <mi resource="1" property="stex:arg">1</mi>
        <mrow resource="2" property="stex:arg">
          <msup resource="...realarith?exponentiation" property="stex:OMA">

```

¹...and hyperlinks for symbols, and indices, and allows reusing document fragments modularly, and...

```

<mi resource="1" property="stex:arg">2</mi>
<mrow resource="2" property="stex:arg">
  <mi resource="var://n" property="stex:OMV">n</mi>
</mrow>
</msup>
</mrow>
</mfrac>
</mrow>
</mrow>
</mrow>

```

...containing all the semantic information. The MMT system can extract from this the following OPENMATH snippet:

```

<OMBIND>
  <OMID name="...?series?infinitiesum"/>
  <OMV name="n"/>
  <OMLIT name="1"/>
  <OMA>
    <OMS name="...?realarith?division"/>
    <OMLIT name="1"/>
    <OMA>
      <OMS name="...realarith?exponentiation"/>
      <OMLIT name="2"/>
      <OMV name="n"/>
    </OMA>
  </OMA>
</OMBIND>

```

...giving us the full semantics of the snippet, allowing for a plurality of knowledge management services – in particular when serving the `xhtml`.

Remark 4.1.1:

Note that the `html` when opened in a browser will look slightly different than the `pdf` when it comes to highlighting semantic content – that is because naturally `html` allows for much more powerful features than `pdf` does. Consequently, the `html` is intended to be served by a system like MMT, which can pick up on the semantic information and offer much more powerful highlighting, linking and similar features, and being customizable by *readers* rather than being prescribed by an author.

Additionally, not all browsers (most notably Chrome) support MATHML natively, and might require additional external JavaScript libraries such as MathJax to render mathematical formulas properly.

4.2 Mmt/OMDoc Conversion

Another way to convert our document to *actual* MMT/OMDOC is to put it in an `TEX` archive (see [section 5.2](#)) and have MMT take care of everything.

Assuming the above file is `source/demo.tex` in an `TEX` archive `MyTest`, you can run MMT and do `build MyTest stex-omdoc demo.tex` to convert the document to both `xhtml` (which you will find in `xhtml/demo.xhtml` in the archive) and formal MMT/OMDOC, which you can subsequently view in the MMT browser (see <https://>

uniformal.github.io/doc/applications/server.html#the-mmt-web-site for details).

Chapter 5

Creating sTeX Content

We can use sTeX by simply including the package with `\usepackage{stex}`, or – primarily for individual fragments to be included in other documents – by using the sTeX document class with `\documentclass{stex}` which combines the standalone document class with the stex package.

Both the stex package and document class offer the following options:

lang (*(⟨language⟩*)*) Languages to load with the babel package.

mathhub (*(⟨directory⟩)*) MathHub folder to search for repositories – this is not necessary if the MATHHUB system variable is set.

writesms (*(⟨boolean⟩)*) with this package option, sTeX will write the contents of all external modules imported via `\importmodule` or `\usemodule` into a file `\jobname.sms` (analogously to the table of contents `.toc`-file).

usesms (*(⟨boolean⟩)*) subsequently tells sTeX to read the generated sms-file at the beginning of the document. This allows for e.g. collaborating on documents without all authors having to have all used archives and modules available – one author can load the modules with **writesms**, and the rest can use the modules with **usesms**. Furthermore, the sms file can be submitted alongside a `tex`-file, effectively making it “standalone”.

image (*(⟨boolean⟩)*) passed on to tikzinput.

debug (*(⟨log-prefix⟩*)*) Logs debugging information with the given prefixes to the terminal, or all if **all** is given. Largely irrelevant for the majority of users.

5.1 How Knowledge is Organized in sTeX

sTeX content is organized on multiple levels:

1. sTeX **archives** (see [section 5.2](#)) contain individual `.tex`-files.
2. These may contain sTeX **modules**, introduced via `\begin{smodule}{ModuleName}`.

3. Modules contain $\text{\S}\text{\TeX}$ **symbol declarations**, introduced via `\symdecl{symbolname}`, `\symdef{symbolname}` and some other constructions. Most symbols have a *notation* that can be used via a *semantic macro* `\symbolname` generated by symbol declarations.
4. $\text{\S}\text{\TeX}$ **expressions** finally are built up from usages of semantic macros.

- $\text{\S}\text{\TeX}$ archives are simultaneously MMT archives, and the same directory structure is consequently used.
 - $\text{\S}\text{\TeX}$ modules correspond to OMDOC/MMT *theories*. `\importmodules` (and similar constructions) induce MMT `\includes` and other *theory morphisms*, thus giving rise to a *theory graph* in the OMDOC sense [RK13].
 - Symbol declarations induce OMDOC/MMT *constants*, with optional (formal) *type* and *definiens* components.
 - Finally, $\text{\S}\text{\TeX}$ expressions are converted to OMDOC/MMT terms, which use the abstract syntax (and XML encoding) of OPENMATH [Bus+04].

$\hookrightarrow M \rightarrow$
 $\hookrightarrow M \rightarrow$
 $\hookrightarrow T \rightarrow$

5.2 $\text{\S}\text{\TeX}$ Archives

5.2.1 The Local MathHub-Directory

`\usemodule`, `\importmodule`, `\inputref` etc. allow for including content modularly without having to specify absolute paths, which would differ between users and machines. Instead, $\text{\S}\text{\TeX}$ uses *archives* that determine the global namespaces for symbols and statements and make it possible for $\text{\S}\text{\TeX}$ to find content referenced via such URIs.

All $\text{\S}\text{\TeX}$ archives need to exist in the local MathHub-directory. $\text{\S}\text{\TeX}$ knows where this folder is via one of four means:

1. If the $\text{\S}\text{\TeX}$ package is loaded with the option `mathhub=/path/to/mathhub`, then $\text{\S}\text{\TeX}$ will consider `/path/to/mathhub` as the local MathHub-directory.
2. If the `mathhub` package option is *not* set, but the macro `\mathhub` exists when the $\text{\S}\text{\TeX}$ -package is loaded, then this macro is assumed to point to the local MathHub-directory; i.e. `\def\mathhub{/path/to/mathhub}\usepackage{stex}` will set the MathHub-directory as `path/to/mathhub`.
3. Otherwise, $\text{\S}\text{\TeX}$ will attempt to retrieve the system variable `MATHHUB`, assuming it will point to the local MathHub-directory. Since this variant needs setting up only *once* and is machine-specific (rather than defined in tex code), it is compatible with collaborating and sharing tex content, and hence recommended.
4. Finally, if all else fails, $\text{\S}\text{\TeX}$ will look for a file `~/stex/mathhub.path`. If this file exists, $\text{\S}\text{\TeX}$ will assume that it contains the path to the local MathHub-directory. This method is recommended on systems where it is difficult to set environment variables.

5.2.2 The Structure of \TeX Archives

An \TeX archive `group/name` is stored in the directory `/path/to/mathhub/group/name`; e.g. assuming your local MathHub-directory is set as `/user/foo/MathHub`, then in order for the `smglom/calculus`-archive to be found by the \TeX system, it needs to be in `/user/foo/MathHub/smgglom/calculus`.

Each such archive needs two subdirectories:

- `/source` – this is where all your tex files go.
- `/META-INF` – a directory containing a single file `MANIFEST.MF`, the content of which we will consider shortly

An additional `lib`-directory is optional, and is where \TeX will look for files included via `\libinput`.

Additionally a *group* of archives `group/name` may have an additional archive `group/meta-inf`. If this `meta-inf`-archive has a `/lib`-subdirectory, it too will be searched by `\libinput` from all tex files in any archive in the `group/*-group`.

We recommend the following additional directory structure in the `source`-folder of an \TeX archive:

- `/source/mod/` – individual \TeX modules, containing symbol declarations, notations, and `\begin{spargraph}[type=symdoc,for=...]` environments for “encyclopaedic” symbol documentations
- `/source/def/` – definitions
- `/source/ex/` – examples
- `/source/thm/` – theorems, lemmata and proofs; preferably proofs in separate files to allow for multiple proofs for the same statement
- `/source/snip/` – individual text snippets such as remarks, explanations etc.
- `/source/frag/` – individual document fragments, ideally only `\inputrefing` snippets, definitions, examples etc. in some desirable order
- `/source/tikz/` – tikz images, as individual `.tex`-files
- `/source/PIC/` – image files.

5.2.3 MANIFEST.MF-Files

The `MANIFEST.MF` in the `META-INF`-directory consists of key-value-pairs, informing \TeX (and associated software) of various properties of an archive. For example, the `MANIFEST.MF` of the `smglom/calculus`-archive looks like this:

```
id: smglom/calculus
source-base: http://mathhub.info/smgglom/calculus
narration-base: http://mathhub.info/smgglom/calculus
dependencies: smglom/arithmetic,smglom/sets,smglom/topology,
              smglom/mv,smglom/linear-algebra,smglom/algebra
responsible: Michael.Kohlhase@FAU.de
title: Elementary Calculus
```

<code>teaser: Terminology for the mathematical study of change.</code> <code>description: desc.html</code>

Many of these are in fact ignored by \TeX , but some are important:

`id`: The name of the archive, including its group (e.g. `smglom/calculus`),

`source-base` or

`ns`: The namespace from which all symbol and module URIs in this repository are formed, see (TODO),

`narration-base`: The namespace from which all document URIs in this repository are formed, see (TODO),

`url-base`: The URL that is formed as a basis for *external references*, see (TODO),

`dependencies`: All archives that this archive depends on. \TeX ignores this field, but MMT can pick up on them to resolve dependencies, e.g. for `lmh install`.

5.2.4 Using Files in \TeX Archives Directly

Several macros provided by \TeX allow for directly including files in repositories. These are:

`\mhinput` `\mhinput` [Some/Archive]{some/file} directly inputs the file `some/file` in the `source-` folder of `Some/Archive`.

`\inputref` `\inputref` [Some/Archive]{some/file} behaves like `\mhinput`, but wraps the input in a `\begingroup ... \endgroup`. When converting to `xhtml`, the file is not input at all, and instead an `html`-annotation is inserted that references the file, e.g. for lazy loading.

In the majority of practical cases `\inputref` is likely to be preferred over `\mhinput` because it leads to less duplication in the generated `xhtml`.

`\ifinput` Both `\mhinput` and `\inputref` set `\ifinput` to “true” during input. This allows for selectively including e.g. bibliographies only if the current file is not being currently included in a larger document.

`\addmhbibresource` `\addmhbibresource` [Some/Archive]{some/file} searches for a file like `\mhinput` does, but calls `\addbibresource` to the result and looks for the file in the archive root directory directly, rather than the `source` directory. Typical invocations are

- `\addmhbibresource{lib/refs.bib}`, which specifies a bibliography in the `lib` folder in the local archive or
- `\addmhbibresource[HW/meta-inf]{lib/refs.bib}` in another.

`\libinput` `\libinput{some/file}` searches for a file `some/file` in

- the `lib`-directory of the current archive, and
- the `lib`-directory of a `meta-inf`-archive in (any of) the archive groups containing the current archive

and include all found files in reverse order; e.g. `\libinput{preamble}` in a `.tex`-file in `smglom/calculus` will *first* input `.../smglom/meta-inf/lib/preamble.tex` and then `../smglom/calculus/lib/preamble.tex`.

`\libinput` will throw an error if *no* candidate for `some/file` is found.

`\libusepackage` `\libusepackage[package-options]{some/file}` searches for a file `some/file.sty` in the same way that `\libinput` does, but will call `\usepackage[package-options]{path/to/some/file}` instead of `\input`.

`\libusepackage` throws an error if not *exactly one* candidate for `some/file` is found.

Remark 5.2.1:

A good practice is to have individual \TeX fragments follow basically this document frame:

```
1 \documentclass{stex}
2 \libinput{preamble}
3 \begin{document}
4   ...
5   \ifinputref \else \libinput{postamble} \fi
6 \end{document}
```

Then the `preamble.tex` files can take care of loading the generally required packages, setting presentation customizations etc. (per archive or archive group or both), and `postamble.tex` can e.g. print the bibliography, index etc.

`\libusepackage` is particularly useful in `preamble.tex` when we want to use custom packages that are not part of \TeX Live. In this case we commit the respective packages in one of the `lib` folders and use `\libusepackage` to load them.

5.3 Module, Symbol and Notation Declarations

5.3.1 The `smodule`-Environment

`smodule` (*env.*) A new module is declared using the basic syntax

```
\begin{smodule}[options]{ModuleName}...\end{smodule}.
```

A module is required to declare any new formal content such as symbols or notations (but not variables, which may be introduced anywhere).

The `smodule`-environment takes several keyword arguments, all of which are optional:

`title` (*(token list)*) to display in customizations.

`type` ($\langle string \rangle^*$) for use in customizations.
`deprecate` ($\langle module \rangle$) if set, will throw a warning when loaded, urging to use $\langle module \rangle$ instead.
`id` ($\langle string \rangle$) for cross-referencing.
`ns` ($\langle URI \rangle$) the namespace to use. *Should not be used, unless you know precisely what you're doing.* If not explicitly set, is computed using `\stex_modules_current_namespace:`.
`lang` ($\langle language \rangle$) if not set, computed from the current file name (e.g. `foo.en.tex`).
`sig` ($\langle language \rangle$) if the current file is a translation of a file with the same base name but a different language suffix, setting `sig=<lang>` will preload the module from that language file. This helps ensuring that the (formal) content of both modules is (almost) identical across languages and avoids duplication.
`creators` ($\langle string \rangle^*$) names of the creators.
`contributors` ($\langle string \rangle^*$) names of contributors.
`srccite` ($\langle string \rangle$) a source citation for the content of this module.

\hookrightarrow An sTeX module corresponds to an MMT/OMDOC *theory*. As such it
 \hookrightarrow gets assigned a module URI (*universal resource identifier*) of the form
 \hookrightarrow `<namespace>?<module-name>`.

By default, opening a module will produce no output whatsoever, e.g.:

Example 1

Input:

```

1 \begin{smodule}[title={This is Some Module}]{SomeModule}
2   Hello World
3 \end{smodule}

```

Output:

Hello World

`\stexpatchmodule` We can customize this behavior either for all modules or only for modules with a specific `type` using the command `\stexpatchmodule[optional-type]{begin-code}{end-code}`. Some optional parameters are then available in `\smodule*`-macros, specifically `\smodulename`, `\smoduletype` and `\smoduleid`.

For example:

Example 2

Input:

```

1 \stexpatchmodule[display]
2 {\textbf{Module (\smodulename)}}\par}
3 {\par\noindent\textbf{End of Module (\smodulename)}}}
4
5 \begin{smodule}[type=display,title={Some New Module}]{SomeModule2}
6   Hello World
7 \end{smodule}

```

Output:

```

Module (Some New Module)
  Hello World
End of Module (Some New Module)

```

5.3.2 Declaring New Symbols and Notations

Inside an `smodule` environment, we can declare new \TeX symbols.

`\symdecl` The most basic command for doing so is using `\symdecl{symbolname}`. This introduces a new symbol with name `symbolname`, arity 0 and semantic macro `\symbolname`.

The starred variant `\symdecl*{symbolname}` will declare a symbol, but not introduce a semantic macro. If we don't want to supply a notation (for example to introduce concepts like “abelian”, which is not something that has a notation), the starred variant is likely to be what we want.

\hookrightarrow `\symdecl` introduces a new OMDOC/MMT constant in the current module (=OMDOC/MMT theory). Correspondingly, they get assigned the URI `<module-URI>?<constant-name>`.

Without a semantic macro or a notation, the only meaningful way to reference a symbol is via `\symref`, `\symname` etc.

Example 3

Input:

```

1 \symdecl*{foo}
2 Given a \symname{foo}, we can...

```

Output:

```

Given a foo, we can...

```

Obviously, most semantic macros should take actual *arguments*, implying that the symbol we introduce is an *operator* or *function*. We can let `\symdecl` know the *arity* (i.e. number of arguments) of a symbol like this:

Example 4

Input:

```

1 \symdecl{binarysymbol}[args=2]
2 \symref{binarysymbol}{this} is a symbol taking two arguments.

```

Output:

```

this is a symbol taking two arguments.

```

So far we have gained exactly ... nothing by adding the arity information: we cannot do anything with the arguments in the text.

We will now see what we can gain with more machinery.

\notation We probably want to supply a notation as well, in which case we can finally actually use the semantic macro in math mode. We can do so using the **\notation** command, like this:

Example 5

Input:

```

1 \notation{binarysymbol}{\text{First: }#1\text{; Second: }#2}
2 $\binarysymbol{a}{b}$

```

Output:

```

First: a; Second: b

```

\hookrightarrow Applications of semantic macros, such as $\binarysymbol{a}{b}$ are translated to
 \rightarrow MMT/OMDOC as OMA-terms with head `<OMS name="...?binarysymbol"/>`.
 \rightsquigarrow Semantic macros with no arguments correspond to OMS directly.

\comp For many semantic services e.g. semantic highlighting or **wikification** (linking user-visible notation components to the definition of the respective symbol they come from), we need to specify the notation components. Unfortunately, there is currently no way the \TeX engine can infer this by itself, so we have to specify it manually in the notation specification. We can do so with the **\comp** command.

We can introduce a new notation **highlight** for \binarysymbol that fixes this flaw, which we can subsequently use with $\binarysymbol[\text{highlight}]$:

Example 6

Input:

```
1 \notation{binarysymbol}[highlight]
2   {\comp{\text{First: }}#1\comp{\text{; Second: }}#2}
3 $\binarysymbol[highlight]{a}{b}$
```

Output:

First: a ; Second: b



Ideally, `\comp` would not be necessary: Everything in a notation that is *not* an argument should be a notation component. Unfortunately, it is computationally expensive to determine where an argument begins and ends, and the argument markers `#n` may themselves be nested in other macro applications or \TeX groups, making it ultimately almost impossible to determine them automatically while also remaining compatible with arbitrary highlighting customizations (such as tooltips, hyperlinks, colors) that users might employ, and that are ultimately invoked by `\comp`.



Note that it is required that

1. the argument markers `#n` never occur inside a `\comp`, and
2. no semantic arguments may ever occur inside a notation.

Both criteria are not just required for technical reasons, but conceptionally meaningful:

The underlying principle is that the arguments to a semantic macro represent *arguments to the mathematical operation* represented by a symbol. For example, a semantic macro `\addition{a}{b}` taking two arguments would represent *the actual addition of (mathematical objects) a and b*. It should therefore be impossible for a or b to be part of a notation component of `\addition`.

Similarly, a semantic macro can not conceptually be part of the notation of `\addition`, since a semantic macro represents a *distinct mathematical concept* with *its own semantics*, whereas notations are syntactic representations of the very symbol to which the notation belongs.

If you want an argument to a semantic macro to be a purely syntactic parameter, then you are likely somewhat confused with respect to the distinction between the precise *syntax* and *semantics* of the symbol you are trying to declare (which happens quite often even to experienced \TeX users), and might want to give those another thought - quite likely, the macro you aim to implement does not actually represent a semantically meaningful mathematical concept, and you will want to use `\def` and similar native \LaTeX macro definitions rather than semantic macros.

\symdef In the vast majority of cases where a symbol declaration should come with a semantic macro, we will want to supply a notation immediately. For that reason, the `\symdef` command combines the functionality of both `\symdecl` and `\notation` with the optional arguments of both:

Example 7

Input:

```
1 \symdef{newbinarysymbol}[hl,args=2]
2   {\comp{\text{1.: }}#1\comp{\text{; 2.: }}#2}
3 $\newbinarysymbol{a}{b}$
```

Output:

```
1.: a; 2.: b
```

We just declared a new symbol `newbinarysymbol` with `args=2` and immediately provided it with a notation with identifier `hl`. Since `hl` is the *first* (and so far, only) notation supplied for `newbinarysymbol`, using `\newbinarysymbol` without optional argument defaults to this notation.

But one man’s meat is another man’s poison: it is very subjective what the “default notation” of an operator should be. Different communities have different practices. For instance, the complex unit is written as i in Mathematics and as j in electrical engineering. So to allow modular specification and facilitate re-use of document fragments \TeX allows to re-set notation defaults.

\setnotation The first notation provided will stay the default notation unless explicitly changed – this is enabled by the `\setnotation` command: `\setnotation{symbolname}{notation-id}` sets the default notation of `\symbolname` to `notation-id`, i.e. henceforth, `\symbolname` behaves like `\symbolname[notation-id]` from now on.

Often, a default notation is set right after the corresponding notation is introduced – the starred version `\notation*` for that reason introduces a new notation and immediately sets it to be the new default notation. So expressed differently, the *first* `\notation` for a symbol behaves exactly like `\notation*`, and `\notation*{foo}[bar]{...}` behaves exactly like `\notation{foo}[bar]{...}\setnotation{foo}{bar}`.

\textsymdecl In the less mathematical settings where we want a symbol and semantic macro for some concept with a notation *beyond* its mere name, but which should also be available in \TeX ’s text mode, the command `\textsymdecl` is useful. For example, we can declare a symbol `openmath` with the notation `\textsc{OpenMath}` using `\textsymdecl{openmath}[name=OpenMath]{\textsc{OpenMath}}`. The `\openmath` yields `OPENMATH` both in text and math mode.

Operator Notations

Once we have a semantic macro with arguments, such as `\newbinarysymbol`, the semantic macro represents the *application* of the symbol to a list of arguments. What if we want to refer to the operator *itself*, though?

We can do so by supplying the `\notation` (or `\symdef`) with an *operator notation*, indicated with the optional argument `op=`. We can then invoke the operator notation using `\symbolname![notation-identifier]`. Since operator notations never take arguments, we do not need to use `\comp` in it, the whole notation is wrapped in a `\comp` automatically:

Example 8

Input:

```
1 \notation{newbinarysymbol}[ab, op={\text{a:}\cdot\text{; b:}\cdot}]
2 {\comp{\text{a:}}#1\comp{\text{; b:}}#2- \symname{newbinarysymbol} is also
3 occasionally written $\newbinarysymbol![ab]$
```

Output:

`newbinarysymbol` is also occasionally written `a: · ; b: ·`

\hookrightarrow `\symbolname!` is translated to OMDoc/MMT as `<OMS name="...?symbolname"/>` directly.

5.3.3 Argument Modes

The notations so far used *simple* arguments which we call *mode-i* arguments. Declaring a new symbol with `\symdecl{foo}[args=3]` is equivalent to writing `\symdecl{foo}[args=iii]`, indicating that the semantic macro takes three *mode-i* arguments. However, there are three more argument modes which we will investigate now, namely *mode-b*, *mode-a* and *mode-B* arguments.

Mode-b Arguments

A *mode-b* argument represents a *variable* that is *bound* by the symbol in its application, making the symbol a *binding operator*. Typical examples of binding operators are e.g. sums \sum , products \prod , integrals \int , quantifiers like \forall and \exists , that λ -operator, etc.

\hookrightarrow *Mode-b* arguments behave exactly like *mode-i* arguments within $\text{T}_{\text{E}}\text{X}$, but applications of binding operators, i.e. symbols with *mode-b* arguments, are translated to *OMBIND*-terms in OMDoc/MMT, rather than *OMA*.

For example, we can implement a summation operator binding an index variable and taking lower and upper index bounds and the expression to sum over like this:

Example 9

Input:

```
1 \symdef{summation}[args=biii]
2 {\mathop{\comp{\sum}}_{\#1}\comp{=}\#2}^{\#3}\#4}
3 $\summation{\svar{x}}{\#1}\{\svar{n}\}\{\svar{x}}^{\#2}$
```

Output:

$$\sum_{x=1}^n x^2$$

where the variable x is now *bound* by the `\summation`-symbol in the expression.

Mode-a Arguments

Mode-a arguments represent a *flexary argument sequence*, i.e. a sequence of arguments of arbitrary length. Formally, operators that take arbitrarily many arguments don't "exist", but in informal mathematics, they are ubiquitous. Mode-a arguments allow us to write e.g. `\addition{a,b,c,d,e}` rather than having to write something like `\addition{a}\addition{b}\addition{c}\addition{d}\addition{e}`!

`\notation` (and consequently `\symdef`, too) take one additional argument for each mode-a argument that indicates how to "accumulate" a comma-separated sequence of arguments. This is best demonstrated on an example.

Let's say we want an operator representing quantification over an ascending chain of elements in some set, i.e. `\ascendingchain{S}{a,b,c,d,e}{t}` should yield $\forall a <_S b <_S c <_S d <_S e. t$. The "base"-notation for this operator is simply `\comp{\forall} \#2 \comp{. ,} \#3`, where `\#2` represents the full notation fragment *accumulated* from `{a,b,c,d,e}`.

The *additional* argument to `\notation` (or `\symdef`) takes the same arguments as the base notation and two *additional* arguments `\#1` and `\#2` representing successive pairs in the mode-a argument, and accumulates them into `\#2`, i.e. to produce $a <_S b <_S c <_S d <_S e$, we do `\#1 \comp{<}_{\#1} \#2`:

Example 10

Input:

```
1 \symdef{ascendingchain}[args=iaai]
2 {\comp{\forall} \#2 \comp{. ,} \#3}
3 {\#1 \comp{<}_{\#1} \#2}
4
5 Tadaa: $\ascendingchain{S}{a,b,c,d,e}{t}$
```

Output:

Tadaa: $\forall a <_S b <_S c <_S d <_S e. t$

If this seems overkill, keep in mind that you will rarely need the single-hash arguments `#1,#2` etc. in the `a`-notation-argument. For a much more representative and simpler example, we can introduce flexary addition via:

Example 11

Input:

```
1 \symdef{addition}[args=a]{#1}{##1 \comp{+} ##2}
2
3 Tadaa: $\addition{a,b,c,d,e}$
```

Output:

Tadaa: $a+b+c+d+e$

The `assoc`-key We mentioned earlier that “formally”, flexary arguments don’t really “exist”. Indeed, formally, addition is usually defined as a binary operation, quantifiers bind a single variable etc.

Consequently, we can tell $\text{\texttt{STeX}}$ (or, rather, $\text{\texttt{MMT/OMDoc}}$) how to “resolve” flexary arguments by providing `\symdecl` or `\symdef` with an optional `assoc`-argument, as in `\symdecl{addition}[args=a,assoc=bin]`. The possible values for the `assoc`-key are:

`bin`: A binary, associative argument, e.g. as in `\addition`

`binl`: A binary, left-associative argument, e.g. $a^{b^{c^d}}$, which stands for $((a^b)^c)^d$

`binr`: A binary, right-associative argument, e.g. as in $A \rightarrow B \rightarrow C \rightarrow D$, which stands for $A \rightarrow (B \rightarrow (C \rightarrow D))$

`pre`: Successively prefixed, e.g. as in $\forall x, y, z. P$, which stands for $\forall x. \forall y. \forall z. P$

`conj`: Conjunctive, e.g. as in $a = b = c = d$ or $a, b, c, d \in A$, which stand for $a = d \wedge b = d \wedge c = d$ and $a \in A \wedge b \in A \wedge c \in A \wedge d \in A$, respectively

`pwconj`: Pairwise conjunctive, e.g. as in $a \neq b \neq c \neq d$, which stands for $a \neq b \wedge a \neq c \wedge a \neq d \wedge b \neq c \wedge b \neq d \wedge c \neq d$

As before, at the PDF level, this annotation is invisible (and without effect), but at the level of the generated $\text{\texttt{OMDoc/MMT}}$ this leads to more semantical expressions.

Mode-B Arguments

Finally, mode-B arguments simply combine the functionality of both `a` and `b` - i.e. they represent an arbitrarily long sequence of variables to be bound, e.g. for implementing quantifiers:

Example 12

Input:

```

1 \symdef{quantforall}[args=Bi]
2   {\comp{\forall}#1\comp{.}#2}
3   {##1\comp{,}##2}
4
5 \$\quantforall{\svar{x},\svar{y},\svar{z}}{P}$

```

Output:

$\forall x,y,z.P$

5.3.4 Type and Definiens Components

`\symdecl` and `\symdef` take two more optional arguments. \TeX largely ignores them (except for special situations we will talk about later), but MMT can pick up on them for additional services. These are the `type` and `def` keys, which expect expressions in math-mode (ideally using semantic macros, of course!)

The `type` and `def` keys correspond to the `type` and `definiens` components of

- \hookrightarrow OMDoc/MMT constants.
- \hookrightarrow Correspondingly, the name “type” should be taken with a grain of salt, since
- \hookrightarrow OMDoc/MMT – being foundation-independent – does not a priori implement a fixed typing system.

The `type`-key allows us to provide additional information (given the necessary \TeX symbols), e.g. for addition on natural numbers:

Example 13

Input:

```

1 \symdef{Nat}[type=\set]{\comp{\mathbb N}}
2 \symdef{addition}[
3   type=\funtype{\Nat,\Nat}{\Nat},
4   op=+,
5   args=a
6 ]{\#1}{\#1 \comp+ \#2}
7
8 \symname{addition} is an operation $\funtype{\Nat,\Nat}{\Nat}$

```

Output:

`addition` is an operation $\mathbb{N} \times \mathbb{N} \rightarrow \mathbb{N}$

The `def`-key allows for declaring symbols as abbreviations:

Example 14

Input:

```

1 \symdef{successor}[
2   type=\funtype{\Nat}{\Nat},
3   def=\fun{\svar{x}}{\addition{\svar{x},1}},
4   op=\mathtt{succ},
5   args=1
6 ]{\comp{\mathtt{succ}{}#1\comp{}}}
7
8 The \symname{successor} operation $\funtype{\Nat}{\Nat}$
9 is defined as $\fun{\svar{x}}{\addition{\svar{x},1}}$

```

Output:

The `successor` operation $\mathbb{N} \rightarrow \mathbb{N}$ is defined as $x \mapsto x+1$

5.3.5 Precedences and Automated Bracketing

Having done `\addition`, the obvious next thing to implement is `\multiplication`. This is straight-forward in theory:

Example 15

Input:

```

1 \symdef{multiplication}[
2   type=\funtype{\Nat,\Nat}{\Nat},
3   op=\cdot,
4   args=a
5 ]{#1}{##1 \comp{\cdot} ##2}
6
7 \symname{multiplication} is an operation $\funtype{\Nat,\Nat}{\Nat}$

```

Output:

`multiplication` is an operation $\mathbb{N} \times \mathbb{N} \rightarrow \mathbb{N}$

However, if we *combine* `\addition` and `\multiplication`, we notice a problem:

Example 16

Input:

```

1 $\addition{a,\multiplication{b,\addition{c,\multiplication{d,e}}}}$

```

Output:

$a+b \cdot c+d \cdot e$

We all know that \cdot binds stronger than $+$, so the output $a+b\cdot c+d\cdot e$ does not actually reflect the term we wrote. We can of course insert parentheses manually

Example 17

Input:

```
1 $\addition{a,\multiplication{b,(\addition{c,\multiplication{d,e}})}}$
```

Output:

$$a+b\cdot(c+d\cdot e)$$

but we can also do better by supplying *precedences* and have \TeX insert parentheses automatically.

For that purpose, `\notation` (and hence `\symdef`) take an optional argument `prec=<opprec>;<argprec1>x...x<argprec n>`.

We will investigate the precise meaning of `<opprec>` and the `<argprec>`s shortly – in the vast majority of cases, it is perfectly sufficient to think of `prec=` taking a single number and having that be *the* precedence of the notation, where lower precedences (somewhat counterintuitively) bind stronger than higher precedences. So fixing our notations for `\addition` and `\multiplication`, we get:

Example 18

Input:

```
1 \notation{multiplication}[
2   op=\cdot,
3   prec=50
4 ]{#1}{##1 \comp\cdot ##2}
5 \notation{addition}[
6   op=+,
7   prec=100
8 ]{#1}{##1 \comp+ ##2}
9
10 $\addition{a,\multiplication{b,\addition{c,\multiplication{d,e}}}}$
```

Output:

$$a+b\cdot(c+d\cdot e)$$

Note that the precise numbers used for precedences are pretty arbitrary – what matters is which precedences are higher than which other precedences when used in conjunction.

`\infprec`
`\neginfprec`

It is occasionally useful to have “infinitely” high or low precedences to enforce or forbid automated bracketing entirely, e.g. for bracket-like notations such as intervals – for those purposes, `\infprec` and `\neginfprec` exist (which are implemented as the maximal and minimal integer values accordingly).

More precisely, each notation takes

1. One *operator precedence* and
2. one *argument precedence* for each argument.

By default, all precedences are 0, unless the symbol takes no argument, in which case the operator precedence is `\neginfprec` (negative infinity). If we only provide a single number, this is taken as both the operator precedence and all argument precedences.

$\text{\S}\text{\TeX}$ decides whether to insert parentheses by comparing operator precedences to a *downward precedence* p_d with initial value `\infprec`. When encountering a semantic macro, $\text{\S}\text{\TeX}$ takes the operator precedence p_{op} of the notation used and checks whether $p_{op} > p_d$. If so, $\text{\S}\text{\TeX}$ insert parentheses.

When $\text{\S}\text{\TeX}$ steps into an argument of a semantic macro, it sets p_d to the respective argument precedence of the notation used.

In the example above:



1. $\text{\S}\text{\TeX}$ starts out with $p_d = \text{\code{\infprec}}$.
2. $\text{\S}\text{\TeX}$ encounters `\addition` with $p_{op} = 100$. Since $100 \not> \text{\code{\infprec}}$, it inserts no parentheses.
3. Next, $\text{\S}\text{\TeX}$ encounters the two arguments for `\addition`. Both have no specifically provided argument precedence, so $\text{\S}\text{\TeX}$ uses $p_d = p_{op} = 100$ for both and recurses.
4. Next, $\text{\S}\text{\TeX}$ encounters `\multiplication{b,...}`, whose notation has $p_{op} = 50$.
5. We compare to the current downward precedence p_d set by `\addition`, arriving at $p_{op} = 50 \not> 100 = p_d$, so $\text{\S}\text{\TeX}$ again inserts no parentheses.
6. Since the notation of `\multiplication` has no explicitly set argument precedences, $\text{\S}\text{\TeX}$ uses the operator precedence for all arguments of `\multiplication`, hence sets $p_d = p_{op} = 50$ and recurses.
7. Next, $\text{\S}\text{\TeX}$ encounters the inner `\addition{c,...}` whose notation has $p_{op} = 100$.
8. We compare to the current downward precedence p_d set by `\multiplication`, arriving at $p_{op} = 100 > 50 = p_d$ – which finally prompts $\text{\S}\text{\TeX}$ to insert parentheses, and we proceed as before.

5.3.6 Variables

All symbol and notation declarations require a module with which they are associated, hence the commands `\symdecl`, `\notation`, `\symdef` etc. are disabled outside of `smodule`-environments.

Variables are different – variables are allowed everywhere, are not exported when the current module (if one exists) is imported (via `\importmodule` or `\usemodule`) and (also unlike symbol declarations) “disappear” at the end of the current \TeX group.

`\svar` So far, we have always used variables using `\svar{n}`, which marks-up n as a variable with name n . More generally, `\svar[foo]{<texcode>}` marks-up the arbitrary `<texcode>` as representing a variable with name `foo`.

Of course, this makes it difficult to reuse variables, or introduce “functional” variables with arities > 0 , or provide them with a type or definiens.

\vardef For that, we can use the `\vardef` command. Its syntax is largely the same as that of `\symdef`, but unlike symbols, variables have only one notation (TODO: so far?), hence there is only `\vardef` and no `\vardecl`.

Example 19

Input:

```

1 \vardef{varf}[
2   name=f,
3   type=\funtype{\Nat}{\Nat},
4   op=f,
5   args=1,
6   prec=0;\neginfprec
7 ]{\comp{f}#1}
8 \vardef{varn}[name=n,type=\Nat]{\comp{n}}
9 \vardef{varx}[name=x,type=\Nat]{\comp{x}}
10
11 Given a function $\varf!:\funtype{\Nat}{\Nat}$,
12 by $\addition{\varf!,\varn}$ we mean the function\rustexBREAK
13 $\fun{\varx}{\varf{\addition{\varx,\varn}}}$

```

Output:

Given a function $f : \mathbb{N} \rightarrow \mathbb{N}$, by $f+n$ we mean the function $x \mapsto f(x+n)$

(of course, “lifting” addition in the way described in the previous example is an operation that deserves its own symbol rather than abusing `\addition`, but... well.)

TODO: bind=forall/exists

5.3.7 Variable Sequences

Variable *sequences* occur quite frequently in informal mathematics, hence they deserve special support. Variable sequences behave like variables in that they disappear at the end of the current T_EX group and are not exported from modules, but their declaration is quite different.

\varseq A variable sequence is introduced via the command `\varseq`, which takes the usual optional arguments `name` and `type`. It then takes a starting index, an end index and a *notation* for the individual elements of the sequence parametric in an index. Note that both the starting as well as the ending index may be variables.

This is best shown by example:

Example 20

Input:

```

1 \vardef{varn}[name=n,type=\Nat]{\comp{n}}
2 \varseq{seqa}[name=a,type=\Nat]{1}{\varn}{\comp{a}_{#1}}
3
4 The $i$th index of $\seqa!$ is $\seqa{i}$.

```

Output:

The i th index of a_1, \dots, a_n is a_i .

Note that the syntax `\seqa!` now automatically generates a presentation based on the starting and ending index.

TODO: more notations for invoking sequences.

Notably, variable sequences are nicely compatible with `a`-type arguments, so we can do the following:

Example 21

Input:

```
1 $\addition{\seqa}$
```

Output:

$a_1 + \dots + a_n$

Sequences can be *multidimensional* using the `args`-key, in which case the notation's arity increases and starting and ending indices have to be provided as a comma-separated list:

Example 22

Input:

```

1 \vardef{varm}[name=m,type=\Nat]{\comp{m}}
2 \varseq{seqa}[
3   name=a,
4   args=2,
5   type=\Nat,
6 ]{1,1}{\varn,\varm}{\comp{a}_{#1}^{\#2}}
7
8 $\seqa!$ and $\addition{\seqa}$

```

Output:

a_1^1, \dots, a_n^m and $a_1^1 + \dots + a_n^m$

We can also explicitly provide a “middle” segment to be used, like such:

Example 23

Input:

```

1 \varseq{seqa}[
2   name=a,
3   type=\Nat,
4   args=2,
5   mid={\comp{a}_{\varn}^1,\comp{a}_1^2,\ellipses,\comp{a}_{1}^{\varm}}
6 ]{1,1}{\varn,\varm}{\comp{a}_{\#1}^{\#2}}
7
8 $\seqa!$ and $\addition{\seqa}$

```

Output:

$$a_1^1, \dots, a_n^1, a_1^2, \dots, a_1^m, \dots, a_n^m \text{ and } a_1^1 + \dots + a_n^1 + a_1^2 + \dots + a_1^m + \dots + a_n^m$$

5.4 Module Inheritance and Structures

The \TeX features for modular document management are inherited from the OM-Doc/MMT model that organizes knowledge into a graph, where the nodes are theories (called modules in \TeX) and the edges are truth-preserving mappings (called theory morphisms in MMT). We have already seen modules/theories above.

Before we get into theory morphisms in \TeX we will see a very simple application of modules: managing multilinguality modularly.

5.4.1 Multilinguality and Translations

If we load the \TeX document class or package with the option `lang=<lang>`, \TeX will load the appropriate `babel` language for you – e.g. `lang=de` will load the `babel` language `ngerman`. Additionally, it makes \TeX aware of the current document being set in (in this example) *german*. This matters for reasons other than mere `babel`-purposes, though:

Every *module* is assigned a language. If no \TeX package option is set that allows for inferring a language, \TeX will check whether the current file name ends in e.g. `.en.tex` (or `.de.tex` or `.fr.tex`, or...) and set the language accordingly. Alternatively, a language can be explicitly assigned via `\begin{smodule}[lang=<language>]{Foo}`.

Technically, each `smodule`-environment induces *two* OMDoc/MMT theories: `\begin{smodule}[lang=<lang>]{Foo}` generates a theory `some/namespace?Foo` that only contains the “formal” part of the module – i.e. exactly the content that is exported when using `\importmodule`. Additionally, MMT generates a *language theory* `some/namespace/Foo?<lang>` that includes `some/namespace?Foo` and contains all the other document content – variable declarations, includes for each `\usemodule`, etc.

Notably, the language suffix in a filename is ignored for `\usemodule`, `\importmodule` and in generating/computing URIs for modules. This however allows for providing *translations* for modules between languages without needing to duplicate content:

If a module `Foo` exists in e.g. `english` in a file `Foo.en.tex`, we can provide a file `Foo.de.tex` right next to it, and write `\begin{smodule}[sig=en]{Foo}`. The `sig`-key then signifies, that the “signature” of the module is contained in the *english* version of the module, which is immediately imported from there, just like `\importmodule` would.

Additionally to translating the informal content of a module file to different languages, it also allows for customizing notations between languages. For example, the *least common multiple* of two numbers is often denoted as `lcm(a,b)` in english, but is called *kleinstes gemeinsames Vielfaches* in german and consequently denoted as `kgV(a,b)` there.

We can therefore imagine a german version of an `lcm`-module looking something like this:

```
1 \begin{smodule}[sig=en]{lcm}
2   \notation*{lcm}[de]{\comp{\mathtt{kgV}}{(#1,#2)}}
3
4   Das \symref{lcm}{kleinste gemeinsame Vielfache}
5    $\text{lcm}\{a,b\}$  von zwei Zahlen  $a,b$  ist...
6 \end{smodule}
```

If we now do `\importmodule{lcm}` (or `\usemodule{lcm}`) within a *german* document, it will also load the content of the german translation, including the `de`-notation for `\lcm`.

5.4.2 Simple Inheritance and Namespaces

`\importmodule` `\importmodule[Some/Archive]{path?ModuleName}` is only allowed within an `smodule`-environment and makes the symbols declared in `ModuleName` available therein. Additionally the symbols of `ModuleName` will be exported if the current module is imported somewhere else via `\importmodule`.

`\usemodule` behaves the same way, but without exporting the content of the used module.

It is worth going into some detail how exactly `\importmodule` and `\usemodule` resolve their arguments to find the desired module – which is closely related to the *namespace* generated for a module, that is used to generate its URI.



Ideally, \LaTeX would use arbitrary URIs for modules, with no forced relationships between the *logical* namespace of a module and the *physical* location of the file declaring the module – like MMT does things.

Unfortunately, \TeX only provides very restricted access to the file system, so we are forced to generate namespaces systematically in such a way that they reflect the physical location of the associated files, so that \LaTeX can resolve them accordingly. Largely, users need not concern themselves with namespaces at all, but for completeness sake, we describe how they are constructed:

- If `\begin{smodule}{Foo}` occurs in a file `/path/to/file/Foo[.<lang>].tex` which does not belong to an archive, the namespace is `file://path/to/file`.
- If the same statement occurs in a file `/path/to/file/bar[.<lang>].tex`, the namespace is `file://path/to/file/bar`.

In other words: outside of archives, the namespace corresponds to the file URI



with the filename dropped iff it is equal to the module name, and ignoring the (optional) language suffix.

If the current file is in an archive, the procedure is the same except that the initial segment of the file path up to the archive's `source`-folder is replaced by the archive's namespace URI.



Conversely, here is how namespaces/URIs and file paths are computed in import statements, exemplary `\importmodule`:

- `\importmodule{Foo}` outside of an archive refers to module `Foo` in the current namespace. Consequently, `Foo` must have been declared earlier in the same document or, if not, in a file `Foo[.<lang>].tex` in the same directory.
- The same statement *within* an archive refers to either the module `Foo` declared earlier in the same document, or otherwise to the module `Foo` in the archive's top-level namespace. In the latter case, it has to be declared in a file `Foo[.<lang>].tex` directly in the archive's `source`-folder.
- Similarly, in `\importmodule{some/path?Foo}` the path `some/path` refers to either the sub-directory and relative namespace path of the current directory and namespace outside of an archive, or relative to the current archive's top-level namespace and `source`-folder, respectively.

The module `Foo` must either be declared in the file `<top-directory>/some/path/Foo[.<lang>].tex`, or in `<top-directory>/some/path[.<lang>].tex` (which are checked in that order).

- Similarly, `\importmodule[Some/Archive]{some/path?Foo}` is resolved like the previous cases, but relative to the archive `Some/Archive` in the mathhub-directory.
- Finally, `\importmodule{full://uri?Foo}` naturally refers to the module `Foo` in the namespace `full://uri`. Since the file this module is declared in can not be determined directly from the URI, the module must be in memory already, e.g. by being referenced earlier in the same document. Since this is less compatible with a modular development, using full URIs directly is strongly discouraged, unless the module is declared in the current file directly.

`\STEXexport` `\importmodule` and `\usemodule` import all symbols, notations, semantic macros and (recursively) `\importmodules`. If you want to additionally export e.g. convenience macros and other (S_TE_X) code from a module, you can use the command `\STEXexport{<code>}` in your module. Then `<code>` is executed (both immediately and) every time the current module is opened via `\importmodule` or `\usemodule`.



For persistency reasons, everything in an `\STEXexport` is digested by T_EX in the L^AT_EX3-category code scheme. This means that the characters `_` and `:` are considered *letters* and valid parts of control sequence names, and space characters are



ignored entirely. For spaces, use the character `~` instead, and keep in mind, that if you want to use subscripts, you should use `\c_math_subscript_token` instead of `_`!

Also note, that `\newcommand` defines macros *globally* and throws an error if the macro already exists, potentially leading to low-level L^AT_EX errors if we put a `\newcommand` in an `\STEXexport` and the `<code>` is executed more than once in a document – which can happen easily.

A safer alternative is to use macro definition principles, that are safe to use even if the macro being defined already exists, and ideally are local to the current T_EX group, such as `\def` or `\let`.

5.4.3 The `mathstructure` Environment

A common occurrence in mathematics is bundling several interrelated “declarations” together into *structures*. For example:

- A *monoid* is a structure $\langle M, \circ, e \rangle$ with $\circ : M \times M \rightarrow M$ and $e \in M$ such that...
- A *topological space* is a structure $\langle X, \mathcal{T} \rangle$ where X is a set and \mathcal{T} is a topology on X
- A *partial order* is a structure $\langle S, \leq \rangle$ where \leq is a binary relation on S such that...

This phenomenon is important and common enough to warrant special support, in particular because it requires being able to *instantiate* such structures (or, rather, structure *signatures*) in order to talk about (concrete or variable) *particular* monoids, topological spaces, partial orders etc.

`mathstructure` (*env.*) The `mathstructure` environment allows us to do exactly that. It behaves exactly like the `smodule` environment, but is itself only allowed inside an `smodule` environment, and allows for instantiation later on.

How this works is again best demonstrated by example:

Example 24

Input:

```
1 \begin{mathstructure}{monoid}
2   \symdef{universe}[type=\set]{\comp{U}}
3   \symdef{op}[
4     args=2,
5     type=\funtype{\universe,\universe}{\universe},
6     op=\circ
7   ]{\#1 \comp{\circ} \#2}
8   \symdef{unit}[type=\universe]{\comp{e}}
9 \end{mathstructure}
10
11 A \symname{monoid} is...
```

Output:

A *monoid* is...

Note that the `\symname{monoid}` is appropriately highlighted and (depending on your pdf viewer) shows a URI on hovering – implying that the `mathstructure` environment has generated a *symbol* monoid for us. It has not generated a semantic macro though, since we can not use the monoid-symbol *directly*. Instead, we can instantiate it, for example for integers:

Example 25

Input:

```

1 \symdef{Int}[type=\set]{\comp{\mathbb Z}}
2 \symdef{addition}[
3   type=\funtype{\Int,\Int}{\Int},
4   args=2,
5   op=+
6 ]{##1 \comp{+} ##2}
7 \symdef{zero}[type=\Int]{\comp{0}}
8
9 $\mathstruct{\Int,\addition!,\zero}$ is a \symname{monoid}.
```

Output:

$\langle \mathbb{Z}, +, 0 \rangle$ is a monoid.

So far, we have not actually instantiated monoid, but now that we have all the symbols to do so, we can:

Example 26

Input:

```

1 \instantiate{intmonoid}{monoid}{\mathbb{Z}_{+,0}}[
2   universe = Int ,
3   op = addition ,
4   unit = zero
5 ]
6
7 $\intmonoid{universe}$, $\intmonoid{unit}$ and $\intmonoid{op}{a}{b}$.
8
9 Also: $\intmonoid!$
```

Output:

\mathbb{Z} , 0 and $a+b$.
Also: $\mathbb{Z}_{+,0}$

`\instantiate` So summarizing: `\instantiate` takes four arguments: The (macro-)name of the instance, a key-value pair assigning declarations in the corresponding `mathstructure` to symbols currently in scope, the name of the `mathstructure` to instantiate, and lastly a notation for the instance itself.

It then generates a semantic macro that takes as argument the name of a declaration in the instantiated `mathstructure` and resolves it to the corresponding instance of that particular declaration.

`\instantiate` and `mathstructure` make use of the *Theories-as-Types* paradigm (see [MRK18]):

- `mathstructure{<name>}` simply creates a nested theory with name $\hookrightarrow M \rightarrow$ `<name>-structure`. The *constant* `<name>` is defined as `Mod(<name>-structure)`
- $\hookrightarrow M \rightarrow$ – a *dependent record type with manifest fields*, the fields of which are generated
- $\rightsquigarrow T \rightsquigarrow$ from (and correspond to) the constants in `<name>-structure`.

`\instantiate` generates a constant whose definiens is a record term of type `Mod(<name>-structure)`, with the fields assigned based on the respective key-value-list.

Notably, `\instantiate` throws an error if not *every* declaration in the instantiated `mathstructure` is being assigned.

You might consequently ask what the usefulness of `mathstructure` even is.

`\varinstantiate` The answer is that we can also instantiate a `mathstructure` with a *variable*. The syntax of `\varinstantiate` is equivalent to that of `\instantiate`, but all of the key-value-pairs are optional, and if not explicitly assigned (to a symbol *or* a variable declared with `\vardef`) inherit their notation from the one in the `mathstructure` environment.

This allows us to do things like:

Example 27

Input:

```

1 \varinstantiate{varM}{monoid}{M}
2
3 A \symname{monoid} is a structure
4 $\varM! := \mathstrut{\varM{universe}, \varM{op}!, \varM{unit}}$
5 such that
6 $\varM{op}!: \funtype{\varM{universe}, \varM{universe}}{\varM{universe}}$ ...

```

Output:

A `monoid` is a structure $M := \langle U, \circ, e \rangle$ such that $\circ : U \times U \rightarrow U$...

.

and

Example 28

Input:

```
1 \varinstantiate{varMb}{monoid}{M_2}[universe = Int]
2
3 Let $\varMb! := \mathstrut{\varMb{universe}, \varMb{op}!, \varMb{unit}}$
4 be a \symname{monoid} on $\Int$ ...
```

Output:

Let $M_2 := \langle \mathbb{Z}, \circ, e \rangle$ be a monoid on \mathbb{Z} ...

.

We will return to these two example later, when we also know how to handle the *axioms* of a monoid.

usestructure (*env.*) The `usestructure{<struct>}` environment is used in multilingual settings as a parallel to the `mathstructure`. It opens a group and then issues a `\usemodule{.../<struct>-structure}` that gives the body access to all the semantic macros in the referenced structure.

5.4.4 The copymodule Environment

TODO: explain

Given modules:

Example 29

Input:

```
1 \begin{smodule}{magma}
2   \symdef{universe}{\comp{\mathcal U}}
3   \symdef{operation}[args=2,op=\circ]{#1 \comp \circ #2}
4 \end{smodule}
5 \begin{smodule}{monoid}
6   \importmodule{magma}
7   \symdef{unit}{\comp e}
8 \end{smodule}
9 \begin{smodule}{group}
10  \importmodule{monoid}
11  \symdef{inverse}[args=1]{#1~\comp{-1}}
12 \end{smodule}
```

Output:

.

We can form a module for *rings* by “cloning” an instance of `group` (for addition) and `monoid` (for multiplication), respectively, and “glueing them together” to ensure they share the same universe:

Example 30

Input:

```

1 \begin{smodule}{ring}
2   \begin{copymodule}{group}{addition}
3     \renamedekl[name=universe]{universe}{runiverse}
4     \renamedekl[name=plus]{operation}{rplus}
5     \renamedekl[name=zero]{unit}{rzero}
6     \renamedekl[name=uminus]{inverse}{ruminus}
7   \end{copymodule}
8   \notation*{rplus}[plus,op=+,prec=60]{#1 \comp+ #2}
9   \notation*{rzero}[zero]{\comp0}
10  \notation*{ruminus}[uminus,op=-]{\comp- #1}
11  \begin{copymodule}{monoid}{multiplication}
12    \assign{universe}{\runiverse}
13    \renamedekl[name=times]{operation}{rtimes}
14    \renamedekl[name=one]{unit}{rone}
15  \end{copymodule}
16  \notation*{rtimes}[cdot,op=\cdot,prec=50]{#1 \comp\cdot #2}
17  \notation*{rone}[one]{\comp1}
18  Test: $\rtimes a\{rplus c\{rtimes d\}}$
19 \end{smodule}

```

Output:

Test: $a \cdot (c + d \cdot e)$

TODO: explain donotclone

5.4.5 The interpretmodule Environment

TODO: explain

Example 31

Input:

```

1 \begin{smodule}{int}
2   \symdef{Integers}{\comp{\mathbb Z}}
3   \symdef{plus}[args=2,op=+]{#1 \comp+ #2}
4   \symdef{zero}{\comp0}
5   \symdef{uminus}[args=1,op=-]{\comp-#1}
6
7   \begin{interpretmodule}{group}{intisgroup}
8     \assign{universe}{\Integers}
9     \assign{operation}{\plus!}
10    \assign{unit}{\zero}
11    \assign{inverse}{\uminus!}
12  \end{interpretmodule}
13 \end{smodule}

```

Output:

5.5 Primitive Symbols (The $\text{\texttt{sTeX}}$ Metatheory)

The `stex-metatheory` package contains $\text{\texttt{sTeX}}$ symbols so ubiquitous, that it is virtually impossible to describe any flexiformal content without them, or that are required to annotate even the most primitive symbols with meaningful (foundation-independent) “type”-annotations, or required for basic structuring principles (theorems, definitions). As such, it serves as the default meta theory for any $\text{\texttt{sTeX}}$ module.

We can also see the `stex-metatheory` as a foundation of mathematics in the sense of [Rab15], albeit an informal one (the ones discussed there are all formal foundations). The state of the `stex-metatheory` is necessarily incomplete, and will stay so for a long while: It arises as a collection of empirically useful symbols that are collected as more and more mathematics are encoded in $\text{\texttt{sTeX}}$ and are classified as foundational.

Formal foundations should ideally instantiate these symbols with their formal counterparts, e.g. `isa` corresponds to a typing operation in typed setting, or the \in -operator in set-theoretic contexts; `bind` corresponds to a universal quantifier in (n th-order) logic, or a Π in dependent type theories.

We make this theory part of the $\text{\texttt{sTeX}}$ collection due to the obiquity of the symbols involved. Note however, that the metatheory is for all practical purposes a “normal” $\text{\texttt{sTeX}}$ module, and the symbols contained “normal” $\text{\texttt{sTeX}}$ symbols.

Chapter 6

Using \TeX Symbols

Given a symbol declaration `\symdecl{symbolname}`, we obtain a semantic macro `\symbolname`. We can use this semantic macro in math mode to use its notation(s), and we can use `\symbolname!` in math mode to use its operator notation(s). What else can we do?

6.1 `\symref` and its variants

<code>\symref</code> <code>\symname</code>	We have already seen <code>\symname</code> and <code>\symref</code> , the latter being the more general. <code>\symref{<symbolname>}{<code>}</code> marks-up <code><code></code> as referencing <code><symbolname></code> . Since quite often, the <code><code></code> should be (a variant of) the name of the symbol anyway, we also have <code>\symname{<symbolname>}</code> .
---	--

Note that `\symname` uses the *name* of a symbol, not its macroname. More precisely, `\symname` will insert the name of the symbol with “-” replaced by spaces. If a symbol does not have an explicit `name=` given, the two are equal – but for `\symname` it often makes sense to make the two explicitly distinct. For example:

Example 32

Input:

```
1 \symdef{Nat}{[
2   name=natural-number,
3   type=\set
4 ]}{\comp{\mathbb{N}}}}
5
6 A \symname{Nat} is...
```

Output:

```
A natural number is...
```

`\symname` takes two additional optional arguments, `pre=` and `post=` that get prepended or appended respectively to the symbol name.

`\Symname` Additionally, `\Symname` behaves exactly like `\syname`, but will capitalize the first letter of the name:

Example 33

Input:

```
1 \Symname[post=s]{Nat} are...
```

Output:

Natural numbers are...



This is as good a place as any other to explain how \TeX resolves a string `symbolname` to an actual symbol.

If `\symbolname` is a semantic macro, then \TeX has no trouble resolving `symbolname` to the full URI of the symbol that is being invoked.

However, especially in `\syname` (or if a symbol was introduced using `\symdecl*` without generating a semantic macro), we might prefer to use the *name* of a symbol directly for readability – e.g. we would want to write A `\syname{natural-number}` is... rather than A `\syname{Nat}` is.... \TeX attempts to handle this case thusly:

If `string` does *not* correspond to a semantic macro `\string` and does *not* contain a `?`, then \TeX checks all symbols currently in scope until it finds one, whose name is `string`. If `string` is of the form `pre?name`, \TeX first looks through all modules currently in scope, whose full URI ends with `pre`, and then looks for a symbol with name `name` in those. This allows for disambiguating more precisely, e.g. by saying `\syname{Integers?addition}` or `\syname{RealNumbers?addition}` in the case where several `additions` are in scope.

6.2 Marking Up Text and On-the-Fly Notations

We can also use semantic macros outside of text mode though, which allows us to annotate arbitrary text fragments.

Let us assume again, that we have `\symdef{addition}[args=2]{#1 \comp+ #2}`. Then we can do

Example 34

Input:

```
1 \addition{\comp{The sum of} \arg{\$svar{n}} \comp{ and } \arg{\$svar{m}}}{
2 is...}
```

Output:

The sum of n and m is...

...which marks up the text fragment as representing an *application* of the `addition`-symbol to two argument n and m .

\hookrightarrow As expected, the above example is translated to OMDoc/MMT as an
 \hookrightarrow OMA with `<OMS name="...?addition"/>` as head and `<OMV name="n"/>` and
 \hookrightarrow `<OMV name="m"/>` as arguments.



Note the difference in treating “arguments” between math mode and text mode. In math mode the (in this case two) tokens/groups following the `\addition` macro are treated as arguments to the addition function, whereas in text mode the group following `\addition` is taken to be the ad-hoc presentation. We drill in on this now.

\arg In text mode, every semantic macro takes exactly one argument, namely the text-fragment to be annotated. The `\arg` command is only valid within the argument to a semantic macro and marks up the *individual arguments* for the symbol.

We can also use semantic macros in text mode to invoke an operator itself instead of its application, with the usual syntax using `!`:

Example 35

Input:

```
1 \addition!{Addition} is...
```

Output:

```
Addition is...
```

Indeed, `\symbolname!{<code>}` is exactly equivalent to `\symref{symbolname}{<code>}` (the latter is in fact implemented in terms of the former).

`\arg` also allows us to switch the order of arguments around and “hide” arguments: For example, `\arg[3]{<code>}` signifies that `<code>` represents the *third* argument to the current operator, and `\arg*[i]{<code>}` signifies that `<code>` represents the *i*th argument, but it should not produce any output (it is exported in the `xhtml` however, so that MMT and other systems can pick up on it).¹

Example 36

Input:

```
1 \addition{\comp{adding}
2   \arg[2]{\svar{k}}$}
3   \arg*{\svar{n}}{\svar{m}}$} yields...
```

¹EDNOTE: MK: I do not understand why we have to/want to give the second `arg*`; I think this must be elaborated on.

Output:

adding k yields...

Note that since the second `\arg` has no explicit argument number, it automatically represents the first not-yet-given argument – i.e. in this case the first one.²

The same syntax can be used in math mod as well. This allows us to spontaneously introduce new notations on the fly. We can activate it using the starred variants of semantic macros:

Example 37

Input:

```
1 Given $\addition{\svar{n}}{\svar{m}}$, then
2 $\addition*{
3   \arg*{\addition{\svar{n}}{\svar{m}}}
4   \comp{+}
5   \arg{\svar{k}}
6 }$ yields...
```

Output:

Given $n+m$, then $+k$ yields...

If we take features like `\inputref` and `\mhinput` (and the `sfragment`-environment, see [subsection 9.2.1](#)) seriously, and build large documents modularly from individually compiling documents for sections, chapters and so on, cross-referencing becomes an interesting problem.

Say, we have a document `main.tex`, which `\inputrefs` a section `section1.tex`, which references a definition with label `some_definition` in `section2.tex` (subsequently also inputted in `main.tex`). Then the numbering of the definition will depend on the *document context* in which the document fragment `section2.tex` occurs - in `section2.tex` itself (as a standalone document), it might be *Definition 1*, in `main.tex` it might be *Definition 3.1*, and in `section1.tex`, the definition *does not even occur*, so it needs to be referenced by some other text.

What we would want in that instance is an equivalent of `\autoref`, that takes the document context into account to yield something like *Definition 1*, *Definition 3.1* or *Definition 1 in the section on Foo* respectively.

The `\sref` command attempts to do precisely that. Unlike plain `\ref`, `\autoref` etc., `\sref` refers to not just a *label*, but instead a pair consisting of a *label* and the *document* in whose context we want to refer to it. Conversely, every *document* (i.e. standalone compilable `.tex`-file) keeps track of the “names” (*Definition 3.1* etc.) for every label as determined in the context of the document, and stores them in a dedicated file `\jobname.sref`. Additionally, every document has a “reference name” (e.g. “*the section on Foo*”). This allows us to refer to “label x in document D ” to yield “*Definition 1 in the section on Foo*”. And of course, \TeX can decide based on the current document

²EdNOTE: MK: I do not understand this at all.

to either refer to the label by its “full name” or directly as e.g. *Definition 3.1* depending on whether the label occurs in the current document anyway (and link to it accordingly).

For that to work, we need to supply (up to) three pieces of information:

- The *label* of the reference target (e.g. `some_definition`),
- (optionally) the *file*/document containing the reference target (e.g. `section2`). This is not strictly necessary, but allows for additional disambiguation between possibly duplicate labels across files, and
- (optionally) the document context, in which we want to refer to the reference target (e.g. `main`).

Additionally, the document in which we want to reference a label needs a title for external references.

```
\sref[archive=<archive1>,file=<file>]
{\<label>}[archive=<archive2>,in=<document-context>,title=<title>]
```

This command references *<label>* (declared in *<file>* in *<archive1>*). If the object (section, figure, etc.) with that label occurs ultimately in the same document, `\sref` will ignore the second set of optional arguments and simply defer to `\autoref` if that command exists, or `\ref` if the `hyperref` package is not included.

If the referenced object does *not* occur in the current document however, `\sref` will refer to it by the object’s name as it occurs in the file *<document-context>* in *<archive2>*.

For example, the reference to the `sfragment`-environment above will appear as “subsection 7.2.1 (Introduction) in the \TeX 3 manual” if you are reading this in the package documentation for `stex-references` directly, but as a linked “subsection 7.2.1” in the full documentation or manual. This is achieved using

```
\sref[file=stex-document-structure]{sec:ds:intro}[in=../stex-manual,title={the \stex}]
```

For a further example, the following:

Part III

will say “Part III” (and link accordingly) in the full documentation, and “Part III (Extensions) in the full \TeX 3 documentation” everywhere else. This is achieved using

```
\sref[file=../stex-doc]{part:extends}[in=../stex-doc,title={the full \stex}3 document]
```

```
\extref\sref[archive=<archive1>,file=<file>]
{\<label>}[archive=<archive2>,in=<document-context>,title=<title>]}
```

The `\extref`-command behaves exactly like `\sref`, but takes *required* the document context argument and will always use it for generating the document text, regardless of whether the label occurs in the current document.

Chapter 7

STEX Statements

7.1 Definitions, Theorems, Examples, Paragraphs

As mentioned earlier, we can semantically mark-up *statements* such as definitions, theorems, lemmata, examples, etc.

The corresponding environments for that are:

- `sdefinition` for definitions,
- `sassertion` for assertions, i.e. propositions that are declared to be *true*, such as theorems, lemmata, axioms,
- `sexample` for examples and counterexamples, and
- `sparagraph` for “other” semantic paragraphs, such as comments, remarks, conjectures, etc.

The *presentation* of these environments can be customized to use e.g. predefined `theorem-environments`, see [section 7.3](#) for details.

All of these environments take optional arguments in the form of `key=value`-pairs. Common to all of them are the keys `id=` (for cross-referencing, see [chapter 8](#)), `type=` for customization (see [section 7.3](#)) and additional information (e.g. definition principles, “difficulty” etc), as well as `title=` (for giving the paragraph a title), and finally `for=`.

The `for=` key expects a comma-separated list of existing symbols, allowing for e.g. things like

Example 38

Input:

```
1 \begin{sexample}[
2   id=additionandmultiplication.ex,
3   for={addition,multiplication},
4   type={trivial,boring},
5   title={An Example}
6 ]
7   $\text{\addition{2,3}}$ is $5$, $\text{\multiplication{2,3}}$ is $6$.
8 \end{sexample}
```

Output:

Example 7.1.1 (An Example). $2+3$ is 5, $2\cdot 3$ is 6.

`\definiendum` **sdefinition** (and **sparagraph** with `type=symdoc`) introduce three new macros: `\definiendum` behaves like `\symref` (and `\definame`/`\Definame` like `\symname`/`\Symname`, respectively), but highlights the referenced symbol as *being defined* in the current definition.

\hookrightarrow M \rightarrow The special `type=symdoc` for **sparagraph** is intended to be used for “informal definitions”, or encyclopedia-style descriptions for symbols.
 \hookrightarrow M \rightarrow The MMT system can use those (in lieu of an actual **sdefinition** in scope) to
 \hookrightarrow T \rightarrow present to users, e.g. when hovering over symbols.

`\definiens` Additionally, **sdefinition** (and **sparagraph** with `type=symdoc`) introduces `\definiens`[<optional sym which marks up <code> as being the explicit *definiens* of <optional symbolname> (in case `for=` has multiple symbols)].

All four statement environments – i.e. **sdefinition**, **sassertion**, **sexample**, and **sparagraph** – also take an optional parameter `name=` – if this one is given a value, the environment will generate a *symbol* by that name (but with no semantic macro). Not only does this allow for `\symref` et al, it allows us to resume our earlier example for monoids much more nicely:³

Example 39

Input:

³EdNOTE: MK: we should reference the example explicitly here.

```

1 \begin{mathstructure}{monoid}
2   \symdef{universe}[type=\set]{\comp{U}}
3   \symdef{op}[
4     args=2,
5     type=\funtype{\universe,\universe}{\universe},
6     op=\circ
7   ]{#1 \comp{\circ} #2}
8   \symdef{unit}[type=\universe]{\comp{e}}
9
10  \begin{sparagraph}[type=symdoc,for=monoid]
11    A \definame{monoid} is a structure
12    $\mathstruct{\universe,\op!,\unit}$
13    where $\op!:\funtype{\universe}{\universe}$ and
14    $\inset{\unit}{\universe}$ such that
15
16    \begin{sassertion}[name=associative,
17      type=axiom,
18      title=Associativity]
19      $\op!$ is associative
20    \end{sassertion}
21    \begin{sassertion}[name=isunit,
22      type=axiom,
23      title=Unit]
24      $\equal{\op{\svar{x}}{\unit}}{\svar{x}}$
25      for all $\inset{\svar{x}}{\universe}$
26    \end{sassertion}
27  \end{sparagraph}
28 \end{mathstructure}
29
30 An example for a \symname{monoid} is...

```

Output:

A **monoid** is a structure $\langle U, \circ, e \rangle$ where $\circ : U \rightarrow U$ and $e \in U$ such that

Axiom 7.1.2 (Associativity). \circ is associative

Axiom 7.1.3 (Unit). $x \circ e = x$ for all $x \in U$

An example for a **monoid** is...

EdN:4

The main difference to before⁴ is that the two **sassertions** now have **name=** attributes. Thus the **mathstructure monoid** now contains two additional symbols, namely the axioms for associativity and that e is a unit. Note that both symbols do not represent the mere *propositions* that e.g. \circ is associative, but *the assertion that it is actually true* that \circ is associative.

If we now want to instantiate **monoid** (unless with a variable, of course), we also need to assign **associative** and **neutral** to analogous assertions. So the earlier example

```

1 \instantiate{intmonoid}{monoid}{\mathbb{Z}_{+,0}}[
2   universe = Int ,
3   op = addition ,
4   unit = zero
5 ]

```

⁴EdNOTE: MK: reference

...will not work anymore. We now need to give assertions that `addition` is associative and that `zero` is a unit with respect to addition.²

7.2 Proofs

The `stex-proof` package supplies macros and environment that allow to annotate the structure of mathematical proofs in \LaTeX document. This structure can be used by MKM systems for added-value services, either directly from the \LaTeX sources, or after translation.

Its central component is the `sproof`-environment, whose body consists of:

- *subproofs* via the `subproof`-environment,
- *proof steps* via the `\spfstep`, `\eqstep` `\assumption`, and `\conclude` macros, and
- *comments*, via normal text without special markup.

`sproof`, `subproof` and the various proof step macros take the following optional arguments:

`id` ($\langle string \rangle$) for referencing,

`method` ($\langle string \rangle$) the proof method (e.g. contradiction, induction,...)

`term` ($\langle token list \rangle$) the (ideally semantically-marked up) proposition that is derived/proven by this proof/subproof/proof step.

Additionally, they take one mandatory argument for the document text to be annotated, or (in the case of the environments) as an introductory description of the proof itself. Since the latter often contains the `term` to be derived as text, alternatively to providing it as an optional argument, the mandatory argument can use the `\yield`-macro to mark it up in the text.

The `sproof` and `subproof` environments additionally take two optional arguments:

`for` the symbol identifier/name corresponding to the `sassertion` to be proven. This too subsumes `\yield` and the `term`-argument.

`hide` In the pdf, this only shows the mandatory argument text and hides the body of the environment. In the HTML (as served by MMT), the bodies of all `proof` and `subproof` environments are *collapsible*, and `hide` collapses the body by default.

```

1 \begin{sassertion}[type=theorem,name=sqrt2irr]
2   \conclusion{\irrational{\arg{\realroot{2}}$ is \comp{irrational}}}.
3 \end{sassertion}
4
5 \begin{sproof}[for=sqrt2irr,method=contradiction]{By contradiction}
6   \assumption{Assume \yield{\rational{\arg{\realroot{2}}$ is
7     \comp{rational}}}}
8   \begin{subproof}[method=straightforward]{Then
9     \yield{\$eq{\ratfrac{\intpow{\vara}{2}}{\intpow{\varb}{2}}{2}$
10       for some $\inset{\vara,\varb}\PosInt$ with
11       \coprime{\arg{\vara},\arg{\varb}$ \comp{coprime}}}}
```

²Of course, \LaTeX can not check that the assertions are the “correct” ones – but if the assertions (both in monoid as well as those for addition and zero) are properly marked up, MMT can. **TODO: should**

```

12 \assumption{By assumption, \yield{there are
13 $\inset{\vara,\varb}\PosInt$ with
14 $\realroot{2}=\ratfrac{\vara}{\varb}$}}
15 \spfstep{wlog, we can assume \coprime{$\arg{\vara},\arg{\varb}$}
16 to be \comp{coprime}}
17 % a comment:
18 If not, reduce the fraction until numerator and denominator
19 are coprime, and let the resulting components be
20 $\vara$ and $\varb$
21 \spfstep{Then \yield{$\eq{\intpow{\ratfrac{\vara}{\varb}}{2}{2}$}}
22 \eqstep{\ratfrac{\intpow{\vara}{2}}{\intpow{\varb}{2}}}}
23 \end{subproof}
24 \begin{subproof}[term=\divides{2}{\vara},method=straightforward]{
25 Then $\vara$ is even}
26 \spfstep{Multiplying the equation by $\intpow{\varb}{2}$ yields
27 $\yield{\eq{\intpow{\vara}{2}}{\inttimes{2}{\intpow{\varb}{2}}}}$}
28 \spfstep[term=\divides{2}{\intpow{\vara}{2}}]{Hence
29 $\intpow{\vara}{2}$ is even}
30 \conclude[term=\divides{2}{\vara}]{Hence $\vara$ is even as well}
31 % another comment:
32 Hint: Think about the prime factorizations of $\vara$ and
33 $\intpow{\vara}{2}$
34 \end{subproof}
35 \begin{subproof}[term=\divides{2}{\varb},method=straightforward,]{
36 Then $\varb$ is also even}
37 \spfstep{Since $\vara$ is even, we have \yield{some $\varc$ $
38 such that $\eq{\inttimes{2}{\varc}}{\vara}$}}
39 \spfstep{Plugging into the above, we get
40 \yield{$\eq{\intpow{\inttimes{2}{\vara}}{2}
41 {\inttimes{2}{\intpow{\varb}{2}}}$}}
42 \eqstep{\inttimes{4}{\intpow{\vara}{2}}}
43 \spfstep{Dividing both sides by $2$ yields
44 \yield{$\eq{\intpow{\varb}{2}}{\inttimes{2}{\intpow{\vara}{2}}}$}}
45 \spfstep[term=\divides{2}{\intpow{\varb}{2}}]{Hence
46 $\intpow{\varb}{2}$ is even}
47 \conclude[term=\divides{2}{\varb}]{Hence $\varb$ is even}
48 % one more comment:
49 By the same argument as above
50 \end{subproof}
51 \conclude[term=\contradiction]{Contradiction to $\vara,\varb$ being
52 \symname{coprime}.}
53 \end{spproof}

```

which will produce:

Theorem 7.2.1. $\sqrt{2}$ is *irrational*.

Proof: By contradiction

1. Assume $\sqrt{2}$ is *rational*
2. Then $(\frac{a}{b})^2=2$ for some $a,b \in \mathbb{Z}^+$ with a,b *coprime*
 - 2.1. By assumption, there are $a,b \in \mathbb{Z}^+$ with $\sqrt{2} = \frac{a}{b}$
 - 2.2. wlog, we can assume a,b to be *coprime*

If not, reduce the fraction until numerator and denominator are coprime, and let the re-

ulting components be a and b

2.3. Then $(\frac{a}{b})^2=2$

$$= \frac{a^2}{b^2}$$

3. Then a is even

3.1. Multiplying the equation by b^2 yields $a^2=2b^2$

3.2. Hence a^2 is even

\Rightarrow Hence a is even as well

Hint: Think about the prime factorizations of a and a^2

4. Then b is also even

4.1. Since a is even, we have some c such that $2c=a$

4.2. Plugging into the above, we get $(2a)^2=2b^2$

$$= 4a^2$$

4.3. Dividing both sides by 2 yields $b^2=2a^2$

4.4. Hence b^2 is even

\Rightarrow Hence b is even

By the same argument as above

\Rightarrow Contradiction to a, b being coprime.

□

If we mark all subproofs with `hide`, we will obtain the following instead:

Theorem 7.2.2. $\sqrt{2}$ is irrational.

Proof: By contradiction

1. Assume $\sqrt{2}$ is rational

2. Then $(\frac{a}{b})^2=2$ for some $a, b \in \mathbb{Z}^+$ with a, b coprime

3. Then a is even

4. Then b is also even

\Rightarrow Contradiction to a, b being coprime.

□

However, the hidden subproofs will still be shown in the HTML, only in an expandable section which is collapsed by default.

The above style of writing proofs is usually called *structured proofs*. They have a huge advantage over the traditional purely prosaic style, in that (as the name suggests) the actual *structure* of the proof is made explicit, which almost always makes it considerably more comprehensible. We, among many others, encourage the general use of structured proofs.

Alas, most proofs are not written in this style, and we would do users a disservice by insisting on this style. For that reason, the `spfblock` environment turns all subproofs and proof step macros into presentationally neutral *inline* annotations, as in the induction step of the following example:

```
1 \begin{sproof}[id=simple-proof,method=induction]
2   {We prove that  $\sum_{i=1}^n 2i-1=n^2$  by induction over  $n$ }
```

```

3 For the induction we have to consider three cases: % <- a comment
4 \begin{subproof}{\$n=1\$}
5   \spfstep*{then we compute  $1=1^2$ }
6 \end{subproof}
7 \begin{subproof}{\$n=2\$}
8   This case is not really necessary, but we do it for the
9   fun of it (and to get more intuition).
10  \spfstep*{We compute  $1+3=2^2=4$ }.
11 \end{subproof}
12 \begin{subproof}{\$n>1\$}\begin{spfblock}
13   \assumption[id=ind-hyp]{
14     Now, we assume that the assertion is true for a certain  $k \geq 1$ ,
15     i.e.  $\mathsf{yield}\{\sum_{i=1}^k (2i-1) = k^2\}$ .
16   }
17
18   We have to show that we can derive the assertion for  $n=k+1$  from
19   this assumption, i.e.  $\sum_{i=1}^{k+1} (2i-1) = (k+1)^2$ .
20
21   \spfstep{
22     We obtain  $\mathsf{yield}\{\sum_{i=1}^{k+1} (2i-1) =$ 
23      $\sum_{i=1}^k (2i-1) + 2(k+1) - 1\}$ 
24     \spfjust{by \splitsum{\comp{splitting the sum}}
25     \arg*{\mathsf{yield}\{\sum_{i=1}^{k+1} (2i-1) = (k+1)^2\}}}.
26   }
27   \spfstep{
28     Thus we have  $\mathsf{yield}\{\sum_{i=1}^{k+1} (2i-1) = k^2 + 2k + 1\}$ 
29     \spfjust{by \symname{induction-hypothesis}}.
30   }
31   \conclude{
32     We can \spfjust{\simplification{\comp{simplify} the right-hand side
33     \arg*{ $k^2 + 2k + 1$ }} to
34      $(k+1)^2$ , which proves the assertion.
35   }
36 \end{spfblock}\end{subproof}
37 \conclude{
38   We have considered all the cases, so we have proven the assertion.
39 }
40 \end{spproof}

```

This yields the following result:

Proof: We prove that $\sum_{i=1}^n 2i - 1 = n^2$ by induction over n

For the induction we have to consider three cases:

1. $n = 1$
then we compute $1 = 1^2$
2. $n = 2$
This case is not really necessary, but we do it for the fun of it (and to get more intuition).
We compute $1 + 3 = 2^2 = 4$.
3. $n > 1$
Now, we assume that the assertion is true for a certain $k \geq 1$, i.e. $\sum_{i=1}^k (2i - 1) = k^2$.
We have to show that we can derive the assertion for $n = k + 1$ from this assumption,

i.e. $\sum_{i=1}^{k+1} (2i - 1) = (k + 1)^2$.
 We obtain $\sum_{i=1}^{k+1} 2i - 1 = \sum_{i=1}^k 2i - 1 + 2(k + 1) - 1$ by [splitting the sum](#). Thus
 we have $\sum_{i=1}^{k+1} (2i - 1) = k^2 + 2k + 1$ by [induction hypothesis](#). We can [simplify](#) the
 right-hand side to $k + 1^2$, which proves the assertion.
 \Rightarrow We have considered all the cases, so we have proven the assertion. □

sproof (*env.*) The **sproof** environment is the main container for proofs. It takes an optional **KeyVal** argument that allows to specify the **id** (identifier) and **for** (for which assertion is this a proof) keys. The regular argument of the **proof** environment contains an introductory comment, that may be used to announce the proof style. The **proof** environment contains a sequence of **spfstep**, **spfcomment**, and **spfcases** environments that are used to markup the proof steps.

\spfilea The **\spfilea** macro allows to give a one-paragraph description of the proof idea.

\spfsketch For one-line proof sketches, we use the **\spfsketch** macro, which takes the same optional argument as **sproof** and another one: a natural language text that sketches the proof.

\spfstep Regular proof steps are marked up with the **\spfstep** macro, which takes an optional **KeyVal** argument for annotations. A proof step usually contains a local assertion (the text of the step) together with some kind of evidence that this can be derived from already established assertions.

\yield See above

\spfjust This evidence is marked up with the **\spfjust** macro in the **stex-proofs** package. This environment totally invisible to the formatted result; it wraps the text in the proof step that corresponds to the evidence (ideally, a semantically marked-up term).

\assumption The **\assumption** macro allows to mark up a (justified) assumption.

\justarg

subproof (*env.*) The **subproof** environment is used to mark up a subproof. This environment takes an optional **KeyVal** argument for semantic annotations and a second argument that allows to specify an introductory comment (just like in the **proof** environment). The **method** key can be used to give the name of the proof method executed to make this subproof.

`\sproofend` Traditionally, the end of a mathematical proof is marked with a little box at the end of the last line of the proof (if there is space and on the end of the next line if there isn't), like so:

The `stex-proofs` package provides the `\sproofend` macro for this.

`\sProofEndSymbol` If a different symbol for the proof end is to be used (e.g. *q.e.d*), then this can be obtained by specifying it using the `\sProofEndSymbol` configuration macro (e.g. by specifying `\sProofEndSymbol{q.e.d}`).

Some of the proof structuring macros above will insert proof end symbols for sub-proofs, in most cases, this is desirable to make the proof structure explicit, but sometimes this wastes space (especially, if a proof ends in a case analysis which will supply its own proof end marker). To suppress it locally, just set `proofend={}` in them or use `\sProofEndSymbol{}`.

7.3 Highlighting and Presentation Customizations

The environments starting with `s` (i.e. `smodule`, `sassertion`, `sexample`, `sdefinition`, `sparagraph` and `sproof`) by default produce no additional output whatsoever (except for the environment content of course). Instead, the document that uses them (whether directly or e.g. via `\inputref`) can decide how these environments are supposed to look like.

The `stexthm` package defines some default customizations that can be used, but of course many existing L^AT_EX templates come with their own `definition`, `theorem` and similar environments that authors are supposed (or even required) to use. Their concrete syntax however is usually not compatible with all the additional arguments that S^TE_X allows for semantic information.

Therefore we introduced the separate environments `sdefinition` etc. instead of using `definition` directly. We allow authors to specify how these environments should be styled via the commands `stexpatch*`.

`\stexpatchmodule`
`\stexpatchdefinition`
`\stexpatchassertion`
`\stexpatchexample`
`\stexpatchparagraph`
`\stexpatchproof`

All of these commands take one optional and two proper arguments, i.e. `\stexpatch* [<type>] {<begin-code>} {<end-code>}`.

After S^TE_X reads and processes the optional arguments for these environments, (some of) their values are stored in the macros `\s*<field>` (i.e. `sexampleid`, `\sassertionname`, etc.). It then checks for all the values `<type>` in the `type=`-list, whether an `\stexpatch* [<type>]` for the current environment has been called. If it finds one, it uses the patches `<begin-code>` and `<end-code>` to mark up the current environment. If no patch for (any of) the type(s) is found, it checks whether and `\stexpatch*` was called without optional argument.

For example, if we want to use a predefined `theorem` environment for `sassertions` with `type=theorem`, we can do

```
1 \stexpatchassertion[theorem]{\begin{theorem}}{\end{theorem}}
```

...or, rather, since e.g. `theorem`-like environments defined using `amsthm` take an optional title as argument, we can do:

```

1 \stexpatchassertion[theorem]
2   {\ifx\sassertiontitle\@empty
3     \begin{theorem}
4   \else
5     \begin{theorem}[\sassertiontitle]
6   \fi}
7 {\end{theorem}}

```

Or, if we want *all kinds of sdefinitions* to use a predefined definition-environment irrespective of their type=, then we can issue the following customization patch:

```

1 \stexpatchdefinition
2   {\ifx\sdefinitiontitle\@empty
3     \begin{definition}
4   \else
5     \begin{definition}[\sdefinitiontitle]
6   \fi}
7 {\end{definition}}

```

<hr/>	
<code>\compemph</code>	Apart from the environments, we can control how \TeX highlights variables, notation
<code>\varemp</code>	components, <code>\symrefs</code> and <code>\definiendums</code> , respectively.
<code>\symrefemph</code>	To do so, we simply redefine these four macros. For example, to highlight nota-
<code>\defemph</code>	tion components (i.e. everything in a <code>\comp</code>) in blue, as in this document, we can do
	<code>\def\compemph#1{\textcolor{blue}{#1}}</code> . By default, <code>\compemph</code> et al do nothing.

<hr/>	
<code>\compemph@uri</code>	For each of the four macros, there exists an additional macro that takes the full URI of
<code>\varemp@uri</code>	the relevant symbol currently being highlighted as a second argument. That allows us to
<code>\symrefemph@uri</code>	e.g. use pdf tooltips and links. For example, this document uses ⁵
<code>\defemph@uri</code>	
	<pre> 1 \protected\def\symrefemph@uri#1#2{ 2 \pdftooltip{ 3 \symrefemph{#1} 4 }{ 5 URI:~\detokenize{#2} 6 } 7 } </pre>

By default, `\compemph@uri` is simply defined as `\compemph{#1}` (analogously for the other three commands).

Chapter 8

Cross References

If we take features like `\inputref` and `\mhinput` (and the `sfragment`-environment, see [subsection 9.2.1](#)) seriously, and build large documents modularly from individually compiling documents for sections, chapters and so on, cross-referencing becomes an interesting problem.

Say, we have a document `main.tex`, which `\inputrefs` a section `section1.tex`, which references a definition with label `some_definition` in `section2.tex` (subsequently also inputted in `main.tex`). Then the numbering of the definition will depend on the *document context* in which the document fragment `section2.tex` occurs - in `section2.tex` itself (as a standalone document), it might be *Definition 1*, in `main.tex` it might be *Definition 3.1*, and in `section1.tex`, the definition *does not even occur*, so it needs to be referenced by some other text.

What we would want in that instance is an equivalent of `\autoref`, that takes the document context into account to yield something like *Definition 1*, *Definition 3.1* or *Definition 1 in the section on Foo* respectively.

The `\sref` command attempts to do precisely that. Unlike plain `\ref`, `\autoref` etc., `\sref` refers to not just a *label*, but instead a pair consisting of a *label* and the *document* in whose context we want to refer to it. Conversely, every *document* (i.e. standalone compilable `.tex`-file) keeps track of the “names” (*Definition 3.1* etc.) for every label as determined in the context of the document, and stores them in a dedicated file `\jobname.sref`. Additionally, every document has a “reference name” (e.g. “*the section on Foo*”). This allows us to refer to “label *x* in document *D*” to yield “*Definition 1 in the section on Foo*”. And of course, `TeX` can decide based on the current document to either refer to the label by its “full name” or directly as e.g. *Definition 3.1* depending on whether the label occurs in the current document anyway (and link to it accordingly).

For that to work, we need to supply (up to) three pieces of information:

- The *label* of the reference target (e.g. `some_definition`),
- (optionally) the *file*/document containing the reference target (e.g. `section2`). This is not strictly necessary, but allows for additional disambiguation between possibly duplicate labels across files, and
- (optionally) the document context, in which we want to refer to the reference target (e.g. `main`).

Additionally, the document in which we want to reference a label needs a title for external references.

\sref `\sref[archive=<archive1>,file=<file>]
{<label>}[archive=<archive2>,in=<document-context>,title=<title>]`

This command references *<label>* (declared in *<file>* in *<archive1>*). If the object (section, figure, etc.) with that label occurs ultimately in the same document, `\sref` will ignore the second set of optional arguments and simply defer to `\autoref` if that command exists, or `\ref` if the `hyperref` package is not included.

If the referenced object does *not* occur in the current document however, `\sref` will refer to it by the object's name as it occurs in the file *<document-context>* in *<archive2>*.

For example, the reference to the `sfragment`-environment above will appear as “subsection 7.2.1 (Introduction) in the `gTeX3` manual” if you are reading this in the package documentation for `stex-references` directly, but as a linked “subsection 7.2.1” in the full documentation or manual. This is achieved using

```
\sref[file=stex-document-structure]{sec:ds:intro}[in=./stex-manual,title={the \sTeX}]
```

For a further example, the following:

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will say “Part III” (and link accordingly) in the full documentation, and “Part III (Extensions) in the full `gTeX3` documentation” everywhere else. This is achieved using

```
\sref[file=./stex-doc]{part:extends}[in=./stex-doc,title={the full \sTeX}3 document]
```

\extref `\sref[archive=<archive1>,file=<file>]
{<label>}[archive=<archive2>,in=<document-context>,title=<title>]}`

The `\extref`-command behaves exactly like `\sref`, but takes *required* the document context argument and will always use it for generating the document text, regardless of whether the label occurs in the current document.

Chapter 9

Additional Packages

9.1 Tikzinput: Treating TIKZ code as images

image The behavior of the `ikzinput` package is determined by whether the `image` option is given. If it is not, then the `tikz` package is loaded, all other options are passed on to it and `\tikzinput{⟨file⟩}` inputs the TIKZ file `⟨file⟩.tex`; if not, only the `graphicx` package is loaded and `\tikzinput{⟨file⟩}` loads an image file `⟨file⟩.⟨ext⟩` generated from `⟨file⟩.tex`.

The selective input functionality of the `tikzinput` package assumes that the TIKZ pictures are externalized into a standalone picture file, such as the following one

```
1 \documentclass{standalone}
2 \usepackage{tikz}
3 \usetikzpackage{...}
4 \begin{document}
5   \begin{tikzpicture}
6     ...
7   \end{tikzpicture}
8 \end{document}
```

The `standalone` class is a minimal \LaTeX class that when loaded in a document that uses the `standalone` package: the preamble and the `document` environment are disregarded during loading, so they do not pose any problems. In effect, an `\input` of the file above only sees the `tikzpicture` environment, but the file itself is standalone in the sense that we can run \LaTeX over it separately, e.g. for generating an image file from it.

\tikzinput This is exactly where the `tikzinput` package comes in: it supplies the `\tikzinput` macro, which – depending on the `image` option – either directly inputs the TIKZ picture (source) or tries to load an image file generated from it.

Concretely, if the `image` option is not set for the `tikzinput` package, then `\tikzinput[⟨opt⟩]{⟨file⟩}` disregards the optional argument `⟨opt⟩` and inputs `⟨file⟩.tex` via `\input` and resizes it to as specified in the `width` and `height` keys. If it is, `\tikzinput[⟨opt⟩]{⟨file⟩}` expands to `\includegraphics[⟨opt⟩]{⟨file⟩}`.

`\ctikzinput` is a version of `\tikzinput` that is centered.

<code>\mhtikzinput</code>	<code>\mhtizkinput</code> is a variant of <code>\tikzinput</code> that treats its file path argument as a relative path in a math archive in analogy to <code>\inputref</code> . To give the archive path, we use the <code>mhrepos=</code> key. Again, <code>\cmhtizkinput</code> is a version of <code>\mhtikzinput</code> that is centered.
<code>\cmhtikzinput</code>	

<code>\libusetikzlibrary</code>	Sometimes, we want to supply archive-specific TIKZ libraries in the <code>lib</code> folder of the archive or the <code>meta-inf/lib</code> of the archive group. Then we need an analogon to <code>\libinput</code> for <code>\usetikzlibrary</code> . The <code>stex-tikzinput</code> package provides the <code>libusetikzlibrary</code> for this purpose.
---------------------------------	---

9.2 Modular Document Structuring

9.2.1 Introduction

The `document-structure` package supplies an infrastructure for writing OMDOC documents in \LaTeX . This includes a simple structure sharing mechanism for \LaTeX that allows to move from a copy-and-paste document development model to a copy-and-reference model, which conserves space and simplifies document management. The augmented structure can be used by MKM systems for added-value services, either directly from the \LaTeX sources, or after translation.

The `document-structure` package supplies macros and environments that allow to label document fragments and to reference them later in the same document or in other documents. In essence, this enhances the document-as-trees model to documents-as-directed-acyclic-graphs (DAG) model. This structure can be used by MKM systems for added-value services, either directly from the \LaTeX sources, or after translation. Currently, trans-document referencing provided by this package can only be used in the \LaTeX collection.

DAG models of documents allow to replace the “Copy and Paste” in the source document with a label-and-reference model where document are shared in the document source and the formatter does the copying during document formatting/presentation.

9.2.2 Package Options

The `document-structure` package accepts the following options:

<code>class=<name></code>	load <code><name>.cls</code> instead of <code>article.cls</code>
<code>topsect=<sect></code>	The top-level sectioning level; the default for <code><sect></code> is <code>section</code>

9.2.3 Document Fragments

`sfragment` (*env.*) The structure of the document is given by nested `sfragment` environments. In the \LaTeX route, the `sfragment` environment is flexibly mapped to sectioning commands, inducing the proper sectioning level from the nesting of `sfragment` environments. Correspondingly, the `sfragment` environment takes an optional key/value argument for metadata followed by a regular argument for the (section) title of the sfragment. The optional metadata argument has the keys `id` for an identifier, `creators` and `contributors` for the Dublin Core metadata [DCM03]. The option `short` allows to give a short title for the generated section. If the title contains semantic macros, we need to give the `loadmodules` key (it needs no value). For instance we would have

```

1 \begin{smodule}{foo}
2   \symdef{bar}{Ba_r}
3   ...
4   \begin{sfragment}[id=sec.bardriv,loadmodules]
5     {Introducing $\protect\bar$ Derivations}

```

TeX automatically computes the sectioning level, from the nesting of `sfragment` environments.

But sometimes, we want to skip levels (e.g. to use a `\subsection*` as an introduction for a chapter).

`blindfragment` (*env.*) Therefore the `document-structure` package provides a variant `blindfragment` that does not produce markup, but increments the sectioning level and logically groups document parts that belong together, but where traditional document markup relies on convention rather than explicit markup. The `blindfragment` environment is useful e.g. for creating frontmatter at the correct level. The example below shows a typical setup for the outer document structure of a book with parts and chapters.

```

1 \begin{document}
2 \begin{blindfragment}
3 \begin{blindfragment}
4 \begin{frontmatter}
5 \maketitle\newpage
6 \begin{sfragment}{Preface}
7 ... <<preface>> ...
8 \end{sfragment}
9 \clearpage\setcounter{tocdepth}{4}\tableofcontents\clearpage
10 \end{frontmatter}
11 \end{blindfragment}
12 ... <<introductory remarks>> ...
13 \end{blindfragment}
14 \begin{sfragment}{Introduction}
15 ... <<intro>> ...
16 \end{sfragment}
17 ... <<more chapters>> ...
18 \bibliographystyle{alpha}\bibliography{kwarc}
19 \end{document}

```

Here we use two levels of `blindfragment`:

- The outer one groups the introductory parts of the book (which we assume to have a sectioning hierarchy topping at the part level). This `blindfragment` makes sure that the introductory remarks become a “chapter” instead of a “part”.
- The inner one groups the frontmatter³ and makes the preface of the book a section-level construct. The `frontmatter` environment also suppresses numbering as is traditional for prefaces.

`\skipfragment` The `\skipfragment` “skips an `sfragment`”, i.e. it just steps the respective sectioning counter. This macro is useful, when we want to keep two documents in sync structurally, so that section numbers match up: Any section that is left out in one becomes a `\skipfragment`.

³We shied away from redefining the `frontmatter` to induce a `blindfragment`, but this may be the “right” way to go in the future.

<hr/> <code>\currentsectionlevel</code> <hr/>	The <code>\currentsectionlevel</code> macro supplies the name of the current sectioning level, e.g. “chapter”, or “subsection”. <code>\CurrentSectionLevel</code> is the capitalized variant. They are useful to write something like “In this <code>\currentsectionlevel</code> , we will...” in an <code>sfragment</code> environment, where we do not know which sectioning level we will end up.
<code>\CurrentSectionLevel</code>	

9.2.4 Ending Documents Prematurely

<hr/> <code>\prematurestop</code> <hr/>	For prematurely stopping the formatting of a document, <code>\TeX</code> provides the <code>\prematurestop</code> macro. It can be used everywhere in a document and ignores all input after that – backing out of the <code>sfragment</code> environments as needed. After that – and before the implicit <code>\end{document}</code> it calls the internal <code>\afterprematurestop</code> , which can be customized to do additional cleanup or e.g. print the bibliography.
<code>\afterprematurestop</code>	

`\prematurestop` is useful when one has a driver file, e.g. for a course taught multiple years and wants to generate course notes up to the current point in the lecture. Instead of commenting out the remaining parts, one can just move the `\prematurestop` macro. This is especially useful, if we need the rest of the file for processing, e.g. to generate a theory graph of the whole course with the already-covered parts marked up as an overview over the progress; see `import_graph.py` from the `lmhtools` utilities [LMH].

Text fragments and modules can be made more re-usable by the use of global variables. For instance, the admin section of a course can be made course-independent (and therefore re-usable) by using variables (actually token registers) `courseAcronym` and `courseTitle` instead of the text itself. The variables can then be set in the `\TeX` preamble of the course notes file.

9.2.5 Global Document Variables

To make document fragments more reusable, we sometimes want to make the content depend on the context. We use **document variables** for that.

<hr/> <code>\setSGvar</code> <hr/>	<code>\setSGvar{<vname>}{<text>}</code> to set the global variable <code><vname></code> to <code><text></code> and <code>\useSGvar{<vname>}</code> to reference it.
<code>\useSGvar</code>	

<hr/> <code>\ifSGvar</code> <hr/>	With <code>\ifSGvar</code> we can test for the contents of a global variable: the macro call <code>\ifSGvar{<vname>}{<val>}{<ctext>}</code> tests the content of the global variable <code><vname></code> , only if (after expansion) it is equal to <code><val></code> , the conditional text <code><ctext></code> is formatted.
-----------------------------------	---

9.3 Slides and Course Notes

9.3.1 Introduction

The `notesslides` document class is derived from `beamer.cls` [Tana], it adds a “notes version” for course notes that is more suited to printing than the one supplied by `beamer.cls`.

The `notesslides` class takes the notion of a slide frame from Till Tantau’s excellent `beamer` class and adapts its notion of frames for use in the `\TeX` and OMDoc. To

support semantic course notes, it extends the notion of mixing frames and explanatory text, but rather than treating the frames as images (or integrating their contents into the flowing text), the `notesslides` package displays the slides as such in the course notes to give students a visual anchor into the slide presentation in the course (and to distinguish the different writing styles in slides and course notes).

In practice we want to generate two documents from the same source: the slides for presentation in the lecture and the course notes as a narrative document for home study. To achieve this, the `notesslides` class has two modes: *slides mode* and *notes mode* which are determined by the package option.

9.3.2 Package Options

The `notesslides` class takes a variety of class options:

<code>slides</code>	The options <code>slides</code> and <code>notes</code> switch between slides mode and notes mode (see subsection 9.3.3).
<code>notes</code>	
<code>sectocframes</code>	If the option <code>sectocframes</code> is given, then for the <code>sfragments</code> , special frames with the <code>sfragment</code> title (and number) are generated.
<code>frameimages</code>	If the option <code>frameimages</code> is set, then slide mode also shows the <code>\frameimage</code> -generated frames (see ??). If also the <code>fiboxed</code> option is given, the slides are surrounded by a box.
<code>fiboxed</code>	

9.3.3 Notes and Slides

`frame` (*env.*) Slides are represented with the `frame` environment just like in the `beamer` class, see [\[Tanb\]](#) for details.

`note` (*env.*) The `notesslides` class adds the `note` environment for encapsulating the course note fragments.



Note that it is essential to start and end the `notes` environment at the start of the line – in particular, there may not be leading blanks – else L^AT_EX becomes confused and throws error messages that are difficult to decipher.

By interleaving the `frame` and `note` environments, we can build course notes as shown here:

```

1 \ifnotes\maketitle\else
2 \frame[noframenumbering]\maketitle\fi
3
4 \begin{note}
5   We start this course with ...
6 \end{note}
7
8 \begin{frame}
9   \frametitle{The first slide}
10  ...

```

```

11 \end{frame}
12 \begin{note}
13   ... and more explanatory text
14 \end{note}
15
16 \begin{frame}
17   \frametitle{The second slide}
18   ...
19 \end{frame}
20 ...

```

\ifnotes Note the use of the `\ifnotes` conditional, which allows different treatment between `notes` and `slides` mode – manually setting `\notesttrue` or `\notestfalse` is strongly discouraged however.



We need to give the title frame the `noframenumbering` option so that the frame numbering is kept in sync between the slides and the course notes.



The `beamer` class recommends not to use the `allowframebreaks` option on frames (even though it is very convenient). This holds even more in the `notesslides` case: At least in conjunction with `\newpage`, frame numbering behaves funnily (we have tried to fix this, but who knows).

\inputref* If we want to transclude a the contents of a file as a note, we can use a new variant `\inputref*` of the `\inputref` macro: `\inputref*{foo}` is equivalent to `\begin{note}\inputref{foo}\end{note}`.

`nparagraph` (*env.*) There are some environments that tend to occur at the top-level of `note` environments.

`nparagraph` (*env.*) We make convenience versions of these: e.g. the `nparagraph` environment is just an

`ndefinition` (*env.*) `sparagraph` inside a `note` environment (but looks nicer in the source, since it avoids one

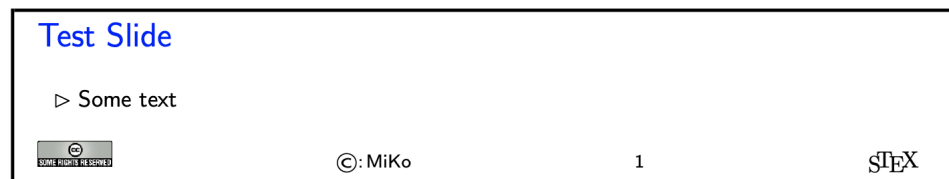
`nexample` (*env.*) level of source indenting). Similarly, we have the `nfragment`, `ndefinition`, `nexample`,

`nsproof` (*env.*) `nsproof`, and `nassertion` environments.

`nassertion` (*env.*)

9.3.4 Customizing Header and Footer Lines

The `notesslides` package and class comes with a simple default theme named `sTeX` that provided by the `beamterthemesTeX`. It is assumed as the default theme for `sTeX`-based notes and slides. The result in `notes` mode (which is like the `slides` version except that the slide height is variable) is



The footer line can be customized. In particular the logos.

`\setslidelogo` The default logo provided by the `notesslides` package is the \LaTeX logo it can be customized using `\setslidelogo{<logo name>}`.

`\setsource` The default footer line of the `notesslides` package mentions copyright and licensing. In `notesslides` `\source` stores the author's name as the copyright holder. By default it is the author's name as defined in the `\author` macro in the preamble. `\setsource{<name>}` can change the writer's name.

`\setlicensing` For licensing, we use the Creative Commons Attribution-ShareAlike license by default to strengthen the public domain. If package `hyperref` is loaded, then we can attach a hyperlink to the license logo. `\setlicensing[<url>]{<logo name>}` is used for customization, where `<url>` is optional.

9.3.5 Frame Images

Sometimes, we want to integrate slides as images after all – e.g. because we already have a PowerPoint presentation, to which we want to add \LaTeX notes.

`\frameimage` In this case we can use `\frameimage[<opt>]{<path>}`, where `<opt>` are the options of `\includegraphics` from the `graphicx` package [CR99] and `<path>` is the file path (extension can be left off like in `\includegraphics`). We have added the `label` key that allows to give a frame label that can be referenced like a regular `beamer` frame.

The `\mhframeimage` macro is a variant of `\frameimage` with repository support. Instead of writing

```
1 \frameimage{\MathHub{fooMH/bar/source/baz/foobar}}
```


we can simply write (assuming that `\MathHub` is defined as above)

```
1 \mhframeimage[fooMH/bar]{baz/foobar}
```

Note that the `\mhframeimage` form is more semantic, which allows more advanced document management features in `MathHub`.

If `baz/foobar` is the “current module”, i.e. if we are on the `MathHub` path `...MathHub/fooMH/bar...`, then stating the repository in the first optional argument is redundant, so we can just use

```
1 \mhframeimage{baz/foobar}
```

`\textwarning` The `\textwarning` macro generates a warning sign: 

9.3.6 Excursions

In course notes, we sometimes want to point to an “excursion” – material that is either presupposed or tangential to the course at the moment – e.g. in an appendix. The typical setup is the following:

```
1 \excursion{founif}{../fragments/founif.en}
2 {We will cover first-order unification in}
3 ...
4 \begin{appendix}\printexcursions\end{appendix}
```

It generates a paragraph that references the excursion whose source is in the file `../fragments/founif.en.tex` and automatically books the file for the `\printexcursions` command that is used here to put it into the appendix. We will look at the mechanics now.

`\excursion` The `\excursion{<ref>}{<path>}{<text>}` is syntactic sugar for

```
1 \begin{nparagraph}[title=Excursion]
2   \activateexcursion{founif}{../ex/founif}
3   We will cover first-order unification in \sref{founif}.
4 \end{nparagraph}
```

`\activateexcursion` Here `\activateexcursion{<path>}` augments the `\printexcursions` macro by a call
`\printexcursion` `\inputref{<path>}`. In this way, the `\printexcursions` macro (usually in the appendix)
`\excursionref` will collect up all excursions that are specified in the main text.

Sometimes, we want to reference – in an excursion – part of another. We can use `\excursionref{<label>}` for that.

`\excursiongroup` Finally, we usually want to put the excursions into an `sfragment` environment and add an introduction, therefore we provide the a variant of the `\printexcursions` macro: `\excursiongroup[id=<id>,intro=<path>]` is equivalent to

```
1 \begin{note}
2 \begin{sfragment}[id=<id>]{Excursions}
3   \inputref{<path>}
4   \printexcursions
5 \end{sfragment}
6 \end{note}
```



When option `book` which uses `\pagestyle{headings}` is given and semantic macros are given in the `sfragment` titles, then they sometimes are not defined by the time the heading is formatted. Need to look into how the headings are made. This is a problem of the underlying document-structure package.

9.4 Representing Problems and Solutions

9.4.1 Introduction

The `problem` package supplies an infrastructure that allows specify problem. Problems are text fragments that come with auxiliary functions: `hints`, `notes`, and `solutions`⁴. Furthermore, we can specify how long the solution to a given problem is estimated to take and how many points will be awarded for a perfect solution.

Finally, the `problem` package facilitates the management of problems in small files, so that problems can be re-used in multiple environment.

9.4.2 Problems and Solutions

<code>solutions</code>	The <code>problem</code> package takes the options <code>solutions</code> (should solutions be output?), <code>notes</code>
<code>notes</code>	(should the problem notes be presented?), <code>hints</code> (do we give the hints?), <code>gnotes</code> (do we
<code>hints</code>	show grading notes?), <code>pts</code> (do we display the points awarded for solving the problem?),
<code>gnotes</code>	<code>min</code> (do we display the estimated minutes for problem soling). If theses are specified, then
<code>pts</code>	the corresponding auxiliary parts of the problems are output, otherwise, they remain
<code>min</code>	invisible.
<code>boxed</code>	The <code>boxed</code> option specifies that problems should be formatted in framed boxes so
<code>test</code>	that they are more visible in the text. Finally, the <code>test</code> option signifies that we are in

a test situation, so this option does not show the solutions (of course), but leaves space for the students to solve them.

`problem (env.)` The main environment provided by the `problempackage` is (surprise surprise) the `problem` environment. It is used to mark up problems and exercises. The environment takes an optional `KeyVal` argument with the keys `id` as an identifier that can be reference later, `pts` for the points to be gained from this exercise in homework or quiz situations, `min` for the estimated minutes needed to solve the problem, and finally `title` for an informative title of the problem.

Example 40

Input:

⁴for the moment multiple choice problems are not supported, but may well be in a future version

```

1 \documentclass{article}
2 \usepackage[solutions,hints,pts,min]{problem}
3 \begin{document}
4   \begin{sproblem}[id=elephants,pts=10,min=2,title=Fitting Elephants]
5     How many Elephants can you fit into a Volkswagen beetle?
6     \begin{hint}
7       Think positively, this is simple!
8     \end{hint}
9     \begin{exnote}
10      Justify your answer
11    \end{exnote}
12  \begin{solution}[for=elephants]
13    Four, two in the front seats, and two in the back.
14    \begin{gnote}
15      if they do not give the justification deduct 5 pts
16    \end{gnote}
17  \end{solution}
18 \end{sproblem}
19 \end{document}

```

Output:

Problem 9.4.1 (Fitting Elephants)
 How many Elephants can you fit into a Volkswagen beetle?

Hint: Think positively, this is simple!

Note: Justify your answer

Solution: Four, two in the front seats, and two in the back.

Grading: if they do not give the justification deduct 5 pts

`solution (env.)` The `solution` environment can be to specify a solution to a problem. If the package option `solutions` is set or `\solutionstrue` is set in the text, then the solution will be presented in the output. The `solution` environment takes an optional KeyVal argument with the keys `id` for an identifier that can be reference `for` to specify which problem this is a solution for, and `height` that allows to specify the amount of space to be left in test situations (i.e. if the `test` option is set in the `\usepackage` statement).

`hint (env.)` The `hint` and `exnote` environments can be used in a `problem` environment to give hints
`exnote (env.)` and to make notes that elaborate certain aspects of the problem. The `gnote` (grading
`gnote (env.)` notes) environment can be used to document situations that may arise in grading.

`\startsolutions` Sometimes we would like to locally override the `solutions` option we have given to
`\stopsolutions` the package. To turn on solutions we use the `\startsolutions`, to turn them off,
`\stopsolutions`. These two can be used at any point in the documents.

`\ifsolutions` Also, sometimes, we want content (e.g. in an exam with master solutions) conditional
on whether solutions are shown. This can be done with the `\ifsolutions` conditional.

9.4.3 Markup for Added-Value Services

The `problem` package is all about specifying the meaning of the various moving parts of practice/exam problems. The motivation for the additional markup is that we can base added-value services from these, for instance auto-grading and immediate feedback.

The simplest example of this are multiple-choice problems, where the `problem` package allows to annotate answer options with the intended values and possibly feedback that can be delivered to the users in an interactive setting. In this section we will give some infrastructure for these, we expect that this will grow over time.

Multiple Choice Blocks

`mcb` (*env.*) Multiple choice blocks can be formatted using the `mcb` environment, in which single choices are marked up with `\mcc` macro.

`\mcc` `\mcc[⟨keyvals⟩]{⟨text⟩}` takes an optional key/value argument `⟨keyvals⟩` for choice meta-data and a required argument `⟨text⟩` for the proposed answer text. The following keys are supported

- `T` for true answers, `F` for false ones,
- `Ttext` the verdict for true answers, `Ftext` for false ones, and
- `feedback` for a short feedback text given to the student.

What we see when this is formatted to PDF depends on the context. In solutions mode (we start the solutions in the code fragment below) we get

Example 41

Input:

```
1 \startsolutions
2 \begin{sproblem}[title=Functions,name=functions1]
3   What is the keyword to introduce a function definition in python?
4   \begin{mcb}
5     \mcc[T]{def}
6     \mcc[F,feedback=that is for C and C++){function}
7     \mcc[F,feedback=that is for Standard ML]{fun}
8     \mcc[F,Ftext=Noooooooooo,feedback=that is for Java]{public static void}
9   \end{mcb}
10 \end{sproblem}
```

Output:

Problem 9.4.2 (Functions)

What is the keyword to introduce a function definition in python?

☐ def

Correct!

☐ function

Wrong! *that is for C and C++*

☐ fun

Wrong! *that is for Standard ML*

☐ public static void

Wrong! *that is for Java*

In “exam mode” where disable solutions (here via \stopsolutions)

Example 42

Input:

```

1 \stopsolutions
2 \begin{sproblem}[title=Functions,name=functions1]
3   What is the keyword to introduce a function definition in python?
4   \begin{mcb}
5     \mcc[T]{def}
6     \mcc[F,feedback=that is for C and C++){function}
7     \mcc[F,feedback=that is for Standard ML]{fun}
8     \mcc[F,Ftext=Nooooooooo,feedback=that is for Java]{public static void}
9   \end{mcb}
10 \end{sproblem}

```

Output:

Problem 9.4.3 (Functions)

What is the keyword to introduce a function definition in python?

☐ def

☐ function

☐ fun

☐ public static void

we get the questions without solutions (that is what the students see during the exam/quiz).

Filling-In Concrete Solutions

The next simplest situation, where we can implement auto-grading is the case where we have fill-in-the-blanks

`\fillinsol` The `\fillinsol` macro takes⁶ an a single argument, which contains a concrete solution (i.e. a number, a string, ...), which generates a fill-in-box in test mode:

Example 43

Input:

```
1 \stopsolutions
2 \begin{problem}[id=elephants.fillin,title=Fitting Elephants]
3   How many Elephants can you fit into a Volkswagen beetle? \fillinsol{4}
4 \end{problem}
```

Output:

Problem 9.4.4 (Fitting Elephants)

How many Elephants can you fit into a Volkswagen beetle?
and the actual solution in solutions mode:

Example 44

Input:

```
1 \begin{problem}[id=elephants.fillin,title=Fitting Elephants]
2   How many Elephants can you fit into a Volkswagen beetle? \fillinsol{4}
3 \end{problem}
```

Output:

Problem 9.4.5 (Fitting Elephants)

How many Elephants can you fit into a Volkswagen beetle? !

If we do not want to leak information about the solution by the size of the blank we can also give `\fillinsol` an optional argument with a size: `\fillinsol[3cm]{12}` makes a box three cm wide.

Obviously, the required argument of `\fillinsol` can be used for auto-grading. For concrete data like numbers, this is immediate, for more complex data like strings “soft comparisons” might be in order.⁷

9.4.4 Including Problems

`\includeproblem` The `\includeproblem` macro can be used to include a problem from another file. It takes an optional KeyVal argument and a second argument which is a path to the file containing the problem (the macro assumes that there is only one problem in the include file). The keys `title`, `min`, and `pts` specify the problem title, the estimated minutes for solving the problem and the points to be gained, and their values (if given) overwrite the ones specified in the `problem` environment in the included file.

The sum of the points and estimated minutes (that we specified in the `pts` and `min` keys to the `problem` environment or the `\includeproblem` macro) to the log file and the

⁷EDNOTE: For the moment we only assume a single concrete value as correct. In the future we will almost certainly want to extend the functionality to multiple answer classes that allow different feedback like in MCQ. This still needs a bit of design. Also we want to make the formatting of the answer in solutions/test mode configurable.

screen after each run. This is useful in preparing exams, where we want to make sure that the students can indeed solve the problems in an allotted time period.

The `\min` and `\pts` macros allow to specify (i.e. to print to the margin) the distribution of time and reward to parts of a problem, if the `pts` and `pts` options are set. This allows to give students hints about the estimated time and the points to be awarded.

9.4.5 Testing and Spacing

The `problem` package is often used by the `hwexam` package, which is used to create homework assignments and exams. Both of these have a “test mode” (invoked by the package option `test`), where certain information –master solutions or feedback – is not shown in the presentation.

`\testspace` `\testspace` takes an argument that expands to a dimension, and leaves vertical space accordingly. Specific instances exist: `\testsmallspace`, `\testsmallspace`, `\testsmallspace` `\testsmallspace` give small (1cm), medium (2cm), and big (3cm) vertical space.
`\testsmallspace` `\testnewpage` makes a new page in `test` mode, and `\testemptypage` generates an empty page with the cautionary message that this page was intentionally left empty.
`\testnewpage`
`\testemptypage`

9.5 Homeworks, Quizzes and Exams

9.5.1 Introduction

The `hwexam` package and class supplies an infrastructure that allows to format nice-looking assignment sheets by simply including problems from problem files marked up with the `problem` package. It is designed to be compatible with `problems.sty`, and inherits some of the functionality.

9.5.2 Package Options

`solutions` The `hwexam` package and class take the options `solutions`, `notes`, `hints`, `gnotes`, `pts`,
`notes` `min`, and `boxed` that are just passed on to the `problems` package (cf. its documentation
`hints` for a description of the intended behavior).
`gnotes`
`pts`
`min`

`multiple` Furthermore, the `hwexam` package takes the option `multiple` that allows to combine multiple assignment sheets into a compound document (the assignment sheets are treated as section, there is a table of contents, etc.).

`test` Finally, there is the option `test` that modifies the behavior to facilitate formatting tests. Only in `test` mode, the macros `\testspace`, `\testnewpage`, and `\testemptypage` have an effect: they generate space for the students to solve the given problems. Thus they can be left in the \LaTeX source.

9.5.3 Assignments

assignment (*env.*) This package supplies the **assignment** environment that groups problems into assignment sheets. It takes an optional KeyVal argument with the keys **number** (for the assignment number; if none is given, 1 is assumed as the default or — in multi-assignment documents **title** — the ordinal of the **assignment** environment), **title** (for the assignment title; this is **type** referenced in the title of the assignment sheet), **type** (for the assignment type; e.g. “quiz”, **given** or “homework”), **given** (for the date the assignment was given), and **due** (for the date the assignment is due).

9.5.4 Including Assignments

\inputassignment The **\inputassignment** macro can be used to input an assignment from another file. It takes an optional KeyVal argument and a second argument which is a path to the file containing the problem (the macro assumes that there is only one **assignment** environment in the included file). The keys **number**, **title**, **type**, **given**, and **due** are just as for the **assignment** environment and (if given) overwrite the ones specified in the **assignment** environment in the included file.

9.5.5 Typesetting Exams

testheading (*env.*) The **\testheading** takes an optional keyword argument where the keys **duration** specifies a string that specifies the duration of the test, **min** specifies the equivalent in number of minutes, and **reqpts** the points that are required for a perfect grade.

```
reqpts 1 \title{320101 General Computer Science (Fall 2010)}
        2 \begin{testheading}[duration=one hour,min=60,reqpts=27]
        3   Good luck to all students!
        4 \end{testheading}
```

Will result in

Name:

Matriculation Number:

320101 General Computer Science (Fall 2010)

2022-09-27

You have one hour (sharp) for the test;

Write the solutions to the sheet.

The estimated time for solving this exam is 60 minutes, leaving you 0 minutes for revising your exam.

You can reach 40 points if you solve all problems. You will only need 27 points for a perfect score, i.e. 13 points are bonus points.

You have ample time, so take it slow and avoid rushing to mistakes!

Different problems test different skills and knowledge, so do not get stuck on one problem.

	To be used for grading, do not write here													
prob.	9.4.1	9.4.2	9.4.3	9.4.4	9.4.5	1.1	2.1	2.2	2.3	3.1	3.2	3.3	Sum	grade
total	10					4	4	6	6	4	4	2	40	
reached														

good luck

EdN:8

8

⁸EDNOTE: MK: The first three “problems” come from the stex examples above, how do we get rid of this?

Part II

Documentation

Chapter 10

STEX-Basics

This sub package provides general set up code, auxiliary methods and abstractions for xhtml annotations.

10.1 Macros and Environments

<code>\sTeX</code>	Both print this ST _E X logo.
<code>\stex</code>	

<code>\stex_debug:nn</code>	<code>\stex_debug:nn {<log-prefix>} {<message>}</code>
-----------------------------	--

Logs *<message>*, if the package option `debug` contains *<log-prefix>*.

10.1.1 HTML Annotations

<code>\if@latexml</code>	L ^A T _E X2e conditional for L ^A T _E X _{ML}
--------------------------	---

<code>\latexml_if_p: *</code>	L ^A T _E X3 conditionals for L ^A T _E X _{ML} .
<code>\latexml_if:TF *</code>	

<code>\stex_if_do_html_p: *</code>	Whether to currently produce any HTML annotations (can be false in some advanced structuring environments, for example)
<code>\stex_if_do_html:TF *</code>	

<code>\stex_suppress_html:n</code>	Temporarily disables HTML annotations in its argument code
------------------------------------	--

We have four macros for annotating generated HTML (via L^AT_EX_{ML} or R_US_TE_X) with attributes:

<code>\stex_annotate:nnn</code>	<code>\stex_annotate:nnn {⟨property⟩} {⟨resource⟩} {⟨content⟩}</code>
<code>\stex_annotate_invisible:nnn</code>	
<code>\stex_annotate_invisible:n</code>	

Annotates the HTML generated by `⟨content⟩` with

`property="stex:⟨property⟩", resource="⟨resource⟩".`

`\stex_annotate_invisible:n` adds the attributes

`stex:visible="false", style="display:none".`

`\stex_annotate_invisible:nnn` combines the functionality of both.

<code>stex_annotate_env (env.)</code>	<code>\begin{stex_annotate_env}{⟨property⟩}{⟨resource⟩}</code> <code>⟨content⟩</code> <code>\end{stex_annotate_env}</code> behaves like <code>\stex_annotate:nnn {⟨property⟩} {⟨resource⟩} {⟨content⟩}</code> .
---------------------------------------	--

10.1.2 Babel Languages

<code>\c_stex_languages_prop</code>
<code>\c_stex_language_abbrevs_prop</code>

Map language abbreviations to their full babel names and vice versa. e.g. `\c_stex_languages_prop{en}` yields `english`, and `\c_stex_language_abbrevs_prop{english}` yields `en`.

10.1.3 Auxiliary Methods

<code>\stex_deactivate_macro:Nn</code>	<code>\stex_deactivate_macro:Nn⟨cs⟩{⟨environments⟩}</code>
<code>\stex_reactivate_macro:N</code>	

Makes the macro `⟨cs⟩` throw an error, indicating that it is only allowed in the context of `⟨environments⟩`.

`\stex_reactivate_macro:N⟨cs⟩` reactivates it again, i.e. this happens ideally in the `⟨begin⟩`-code of the associated environments.

<code>\ignorespacesandpars</code>	ignores white space characters and <code>\par</code> control sequences. Expands tokens in the process.
-----------------------------------	--

Chapter 11

ST_EX-MathHub

This sub package provides code for handling ST_EX archives, files, file paths and related methods.

11.1 Macros and Environments

<code>\stex_kpsewhich:n</code>	<code>\stex_kpsewhich:n</code> executes <code>kpsewhich</code> and stores the return in <code>\l_stex_kpsewhich_return_str</code> . This does not require shell escaping.
--------------------------------	---

11.1.1 Files, Paths, URIs

<code>\stex_path_from_string:Nn</code>	<code>\stex_path_from_string:Nn</code> $\langle path-variable \rangle$ $\{\langle string \rangle\}$ turns the $\langle string \rangle$ into a path by splitting it at <code>/</code> -characters and stores the result in $\langle path-variable \rangle$. Also applies <code>\stex_path_canonicalize:N</code> .
--	--

<code>\stex_path_to_string:NN</code>	The inverse; turns a path into a string and stores it in the second argument variable, or
<code>\stex_path_to_string:N</code>	leaves it in the input stream.

<code>\stex_path_canonicalize:N</code>	Canonicalizes the path provided; in particular, resolves <code>.</code> and <code>..</code> path segments.
--	--

<code>\stex_path_if_absolute_p:N</code> *	
<code>\stex_path_if_absolute:N\underline{T}</code> *	

Checks whether the path provided is *absolute*, i.e. starts with an empty segment

<code>\c_stex_pwd_seq</code>	Store the current working directory as path-sequence and string, respectively, and the
<code>\c_stex_pwd_str</code>	(heuristically guessed) full path to the main file, based on the PWD and <code>\jobname</code> .
<code>\c_stex_mainfile_seq</code>	
<code>\c_stex_mainfile_str</code>	

<code>\g_stex_currentfile_seq</code>	The file being currently processed (respecting <code>\input</code> etc.)
--------------------------------------	--

<code>\stex_filestack_push:n</code>	Push and pop (repectively) a file path to the file stack, to keep track of the current file.
<code>\stex_filestack_pop:</code>	Are called in hooks <code>file/before</code> and <code>file/after</code> , respectively.

11.1.2 MathHub Archives

<code>\mathhub</code>	We determine the path to the local MathHub folder via one of four means, in order of
<code>\c_stex_mathhub_seq</code>	precedence:
<code>\c_stex_mathhub_str</code>	

1. The `mathhub` package option, or
2. the `\mathhub-macro`, if it has been defined before the `\usepackage{stex}`-statement, or
3. the `MATHHUB` system variable, or
4. a path specified in `~/.stex/mathhub.path`.

In all four cases, `\c_stex_mathhub_seq` and `\c_stex_mathhub_str` are set accordingly.

<code>\l_stex_current_repository_prop</code>
--

Always points to the *current* MathHub repository (if we currently are in one). Has the following fields corresponding to the entries in the `MANIFEST.MF`-file:

- `id`: The name of the archive, including its group (e.g. `smglom/calculus`),
- `ns`: The content namespace (for modules and symbols),
- `narr`: the narration namespace (for document references),
- `docurl`: The URL that is used as a basis for *external references*,
- `deps`: All archives that this archive depends on (currently not in use).

<code>\stex_set_current_repository:n</code>

Sets the current repository to the one with the provided ID. calls `__stex_mathhub_do_manifest:n`, so works whether this repository's `MANIFEST.MF`-file has already been read or not.

<code>\stex_require_repository:n</code>	Calls <code>__stex_mathhub_do_manifest:n</code> iff the corresponding archive property list does not already exist, and adds a corresponding definition to the <code>.sms</code> -file.
---	--

<code>\stex_in_repository:nn</code>	<code>\stex_in_repository:nn{<i>repository-name</i>}{<i>code</i>}</code>
-------------------------------------	--

Change the current repository to `{repository-name}` (or not, if `{repository-name}` is empty), and passes its ID on to `{code}` as `#1`. Switches back to the previous repository after executing `{code}`.

11.1.3 Using Content in Archives

<hr/> <code>\mhpath</code> *	<code>\mhpath{<archive-ID>}{<filename>}</code>
	Expands to the full path of file <code><filename></code> in repository <code><archive-ID></code> . Does not check whether the file or the repository exist.
<hr/> <code>\inputref</code> <hr/> <code>\mhinput</code>	<code>\inputref[<archive-ID>]{<filename>}</code> Both <code>\input</code> the file <code><filename></code> in archive <code><archive-ID></code> (relative to the <code>source-</code> subdirectory). <code>\mhinput</code> does so directly. <code>\inputref</code> does so within an <code>\begingroup... \endgroup-</code> block, and skips it in <code>html-mode</code> , inserting a <i>reference</i> to the file instead. Both also set <code>\ifinputref</code> to true.
<hr/> <code>\addmhbibresource</code>	<code>\inputref[<archive-ID>]{<filename>}</code> Adds a <code>.bib</code> -file <code><filename></code> in archive <code><archive-ID></code> (relative to the top-directory of the archive!).
<hr/> <code>\libinput</code>	<code>\libinput{<filename>}</code> Inputs <code><filename>.tex</code> from the <code>lib</code> folders in the current archive and the <code>meta-inf-</code> archive of the current archive group(s) (if existent) in descending order. Throws an error if no file by that name exists in any of the relevant <code>lib</code> -folders.
<hr/> <code>\libusepackage</code>	<code>\libusepackage[<args>]{<filename>}</code> Like <code>\libinput</code> , but looks for <code>.sty</code> -files and calls <code>\usepackage[<meta{args}>]{<Arg{filename}>}</code> instead of <code>\input</code> . Throws an error, if none or more than one suitable package file is found.
<hr/> <code>\mhgraphics</code> <hr/> <code>\cmhgraphics</code>	<i>If</i> the <code>graphicx</code> package is loaded, these macros are defined at <code>\begin{document}</code> . <code>\mhgraphics</code> takes the same arguments as <code>\includegraphics</code> , with the additional optional key <code>mhrepos</code> . It then resolves the file path in <code>\mhgraphics[mhrepos=Foo/Bar]{foo/bar.png}</code> relative to the <code>source</code> -folder of the <code>Foo/Bar</code> -archive. <code>\cmhgraphics</code> additional wraps the image in a <code>center</code> -environment.
<hr/> <code>\lstinputmhlisting</code> <hr/> <code>\clstinputmhlisting</code>	Like <code>\mhgraphics</code> , but only defined if the <code>listings</code> -package is loaded, and with <code>\lstinputlisting</code> instead of <code>\includegraphics</code> .

Chapter 12

STEX-References

This sub package contains code related to links and cross-references

12.1 Macros and Environments

<code>\stex_get_document_uri:</code>	Computes the current document uri from the current archive's narr -field and its location relative to the archive's source -directory. Reference targets are computed from this URI and the reference-id.
--------------------------------------	---

<code>\l_stex_current_docns_str</code>	Stores its result in <code>\l_stex_current_docns_str</code>
--	---

<code>\stex_get_document_url:</code>	Computes the current URL from the current archive's docurl -field and its location relative to the archive's source -directory. Reference targets are computed from this URL and the reference-id, if this document is only included in SMS mode.
--------------------------------------	---

<code>\l_stex_current_docurl_str</code>	Stores its result in <code>\l_stex_current_docurl_str</code>
---	--

12.1.1 Setting Reference Targets

<code>\stex_ref_new_doc_target:n</code>	<code>\stex_ref_new_doc_target:n{<id>}</code> Sets a new reference target with id <code><id></code> .
---	--

<code>\stex_ref_new_sym_target:n</code>	<code>\stex_ref_new_sym_target:n{<uri>}</code> Sets a new reference target for the symbol <code><uri></code> .
---	---

12.1.2 Using References

`\sref` `\sref[<opt-args>]{<id>}`

References the label with if *<id>*. Optional arguments: **TODO**

`\srefsym` `\srefsym[<opt-args>]{<symbol>}`

Like `\sref`, but references the *canonical label* for the provided symbol. The canonical target is the last of the following occurring in the document:

- A `\definiendum` or `\definame` for *<symbol>*,
- The `sassertion`, `sexample` or `sparagraph` with `for=<symbol>` that generated *<symbol>* in the first place, or
- A `\sparagraph` with `type=symdoc` and `for=<symbol>`.

`\srefsymuri` `\srefsymuri{<URI>}{<text>}`

A convenient short-hand for `\srefsym[linktext={<text>}] {<URI>}`, but requires the first argument to be a full URI already. Intended to be used in e.g. `\compemph@uri`, `\defemph@uri`, etc.

Chapter 13

sTeX-Modules

This sub package contains code related to Modules

13.1 Macros and Environments

The content of a module with uri $\langle <URI> \rangle$ is stored in four macros. All modifications of these macros are global:

<hr/> <hr/> <code>\c_stex_module_<URI>_prop</code>	A property list with the following fields: <ul style="list-style-type: none"><code>name</code> The <i>name</i> of the module,<code>ns</code> the <i>namespace</i> in field <code>ns</code>,<code>file</code> the <i>file</i> containing the module, as a sequence of path fragments<code>lang</code> the module's <i>language</i>,<code>sig</code> the language of the signature module, if the current file is a translation from some other language,<code>deprecate</code> if this module is deprecated, the module that replaces it,<code>meta</code> the metatheory of the module.
--	---

<hr/> <hr/> <code>\c_stex_module_<URI>_code</code>	The code to execute when this module is activated (i.e. imported), e.g. to set all the semantic macros, notations, etc.
--	---

<hr/> <hr/> <code>\c_stex_module_<URI>_constants</code>	The names of all constants declared in the module
---	---

<hr/> <hr/> <code>\c_stex_module_<URI>_constants</code>	The full URIs of all modules imported in this module
---	--

<hr/> <hr/>	<hr/>
<code>\l_stex_current_module_str</code>	<code>\l_stex_current_module_str</code> always contains the URI of the current module (if existent).
<hr/> <hr/>	
<code>\l_stex_all_modules_seq</code>	Stores full URIs for all modules currently in scope.
<hr/> <hr/>	
<code>\stex_if_in_module_p: *</code> <code>\stex_if_in_module:TF *</code>	Conditional for whether we are currently in a module
<hr/> <hr/>	
<code>\stex_if_module_exists_p:n *</code> <code>\stex_if_module_exists:nTF *</code>	
	Conditional for whether a module with the provided URI is already known.
<hr/> <hr/>	
<code>\stex_add_to_current_module:n</code> <code>\STEXexport</code>	
	Adds the provided tokens to the <code>_code</code> control sequence of the current module. <code>\stex_add_to_current_module:n</code> is used internally, <code>\STEXexport</code> is intended for users and additionally executes the provided code immediately.
<hr/> <hr/>	
<code>\stex_add_constant_to_current_module:n</code>	
	Adds the declaration with the provided name to the <code>_constants</code> control sequence of the current module.
<hr/> <hr/>	
<code>\stex_add_import_to_current_module:n</code>	
	Adds the module with the provided full URI to the <code>_imports</code> control sequence of the current module.
<hr/> <hr/>	
<code>\stex_collect_imports:n</code>	Iterates over all imports of the provided (full URI of a) module and stores them as a topologically sorted list – including the provided module as the last element – in <code>\l_stex_collect_imports_seq</code>
<hr/> <hr/>	
<code>\stex_do_up_to_module:n</code>	Code that is <i>exported</i> from module (such as symbol declarations) should be local <i>to the current module</i> . For that reason, ideally all symbol declarations and similar commands should be called directly in the module environment, however, that is not always feasible, e.g. in structural features or <code>sparapraphs</code> . <code>\stex_do_up_to_module</code> therefore executes the provided code repeatedly in an <code>\aftergroup</code> up until the group level is equal to that of the innermost smodule environment.

`\stex_modules_current_namespace:`

Computes the current namespace as follows:

If the current file is `.../source/sub/file.tex` in some archive with namespace `http://some.namespace/foo`, then the namespace of is `http://some.namespace/foo/sub/file`. Otherwise, the namespace is the absolute file path of the current file (i.e. starting with `file:///`).

The result is stored in `\l_stex_module_ns_str`. Additionally, the sub path relative to the current repository is stored in `\l_stex_module_subpath_str`.

13.1.1 The `smodule` environment

`module (env.) \begin{module}[\langle options \rangle]{\langle name \rangle}`

Opens a new module with name `\langle name \rangle`. Options are:

`title` (`\langle token list \rangle`) to display in customizations.

`type` (`\langle string \rangle*`) for use in customizations.

`deprecate` (`\langle module \rangle`) if set, will throw a warning when loaded, urging to use `\langle module \rangle` instead.

`id` (`\langle string \rangle`) for cross-referencing.

`ns` (`\langle URI \rangle`) the namespace to use. *Should not be used, unless you know precisely what you're doing.* If not explicitly set, is computed using `\stex_modules_current_namespace:`.

`lang` (`\langle language \rangle`) if not set, computed from the current file name (e.g. `foo.en.tex`).

`sig` (`\langle language \rangle`) if the current file is a translation of a file with the same base name but a different language suffix, setting `sig=<lang>` will preload the module from that language file. This helps ensuring that the (formal) content of both modules is (almost) identical across languages and avoids duplication.

`creators` (`\langle string \rangle*`) names of the creators.

`contributors` (`\langle string \rangle*`) names of contributors.

`srccite` (`\langle string \rangle`) a source citation for the content of this module.

`\stex_module_setup:nn \stex_module_setup:nn{\langle params \rangle}{\langle name \rangle}`

Sets up a new module with name `\langle name \rangle` and optional parameters `\langle params \rangle`. In particular, sets `\l_stex_current_module_str` appropriately.

`\stexpatchmodule \stexpatchmodule [\langle type \rangle] {\langle begincode \rangle} {\langle endcode \rangle}`

Customizes the presentation for those `smodule`-environments with `type=\langle type \rangle`, or all others if no `\langle type \rangle` is given.

`\STEXModule \STEXModule {\langle fragment \rangle}`

Attempts to find a module whose URI ends with `\langle fragment \rangle` in the current scope and passes the full URI on to `\stex_invoke_module:n`.

`\stex_invoke_module:n` Invoked by `\STEXModule`. Needs to be followed either by `!\macro` or `?{\langle symbolname \rangle}`. In the first case, it stores the full URI in `\macro`; in the second case, it invokes the symbol `\langle symbolname \rangle` in the selected module.

<code>\stex_activate_module:n</code>	Activate the module with the provided URI; i.e. executes all macro code of the module's <code>_code</code> -macro (does nothing if the module is already activated in the current context) and adds the module to <code>\l_stex_all_modules_seq</code> .
--------------------------------------	--

Chapter 14

STEX-Module Inheritance

Code related to Module Inheritance, in particular *sms mode*.

14.1 Macros and Environments

14.1.1 SMS Mode

“SMS Mode” is used when loading modules from external tex files. It deactivates any output and ignores all T_EX commands not explicitly allowed via the following lists – all of which either declare module content or are needed in order to declare module content:

`\g_stex_smsmode_allowedmacros_tl`

Macros that are executed as is; i.e. sms mode continues immediately after. These macros may not take any arguments or otherwise gobble tokens.

Initially: `\makeatletter`, `\makeatother`, `\ExplSyntaxOn`, `\ExplSyntaxOff`.

`\g_stex_smsmode_allowedmacros_escape_tl`

Macros that are executed and potentially gobble up further tokens. These macros need to make sure, that the very last token they ultimately expand to is `\stex_smsmode_do:`.

Initially: `\symdecl`, `\notation`, `\symdef`, `\importmodule`, `\STEXexport`, `\inlineass`, `\inlinedef`, `\inlineex`, `\endinput`, `\setnotation`, `\copynotation`.

`\g_stex_smsmode_allowedenvs_seq`

The names of environments that should be allowed in SMS mode. The corresponding `\begin`-statements are treated like the macros in `\g_stex_smsmode_allowedmacros_escape_tl`, so `\stex_smsmode_do:` needs to be the last token in the `\begin`-code. Since `\end`-statements take no arguments anyway, those are called directly and sms mode continues afterwards.

Initially: `smodule`, `copymodule`, `interpretmodule`, `sdefinition`, `sexample`, `sassertion`, `sparagraph`.

`\stex_if_smsmode_p:` ★ Tests whether SMS mode is currently active.
`\stex_if_smsmode:` *TF* ★

<code>\stex_file_in_smsmode:nn</code>	<code>\stex_in_smsmode:nn {<filename>} {<code>}</code>
---------------------------------------	--

Executes `<code>` in SMS mode, followed by the content of `<filename>`. `<code>` can be used e.g. to set the current repository, and is executed within a new tex group, and the same group as the file content.

<code>\stex_smsmode_do:</code>	Starts gobbling tokens until one is encountered that is allowed in SMS mode.
--------------------------------	--

14.1.2 Imports and Inheritance

<code>\importmodule</code>	<code>\importmodule[<archive-ID>]{<module-path>}</code>
----------------------------	---

Imports a module by reading it from a file and “activating” it. `STEX` determines the module and its containing file by passing its arguments on to `\stex_import_module_path:nn`.

<code>\usemodule</code>	<code>\importmodule[<archive-ID>]{<module-path>}</code>
-------------------------	---

Like `\importmodule`, but does not export its contents; i.e. including the current module will not activate the used module

$\backslash\text{stex_import_module_uri:nn}$	$\backslash\text{stex_import_module_uri:nn}$ $\{\langle\text{archive-ID}\rangle\}$ $\{\langle\text{module-path}\rangle\}$
---	--

Determines the URI of a module by splitting $\langle\text{module-path}\rangle$ into $\langle\text{path}\rangle?\langle\text{name}\rangle$. If $\langle\text{module-path}\rangle$ does *not* contain a ?-character, we consider it to be the $\langle\text{name}\rangle$, and $\langle\text{path}\rangle$ to be empty.

If $\langle\text{archive-ID}\rangle$ is empty, it is automatically set to the ID of the current archive (if one exists).

1. If $\langle\text{archive-ID}\rangle$ is empty:

(a) If $\langle\text{path}\rangle$ is empty, then $\langle\text{name}\rangle$ must have been declared earlier in the same file and retrievable from $\backslash\text{g_stex_modules_in_file_seq}$, or a file with name $\langle\text{name}\rangle.\langle\text{lang}\rangle.\text{tex}$ must exist in the same folder, containing a module $\langle\text{name}\rangle$.

That module should have the same namespace as the current one.

(b) If $\langle\text{path}\rangle$ is not empty, it must point to the relative path of the containing file as well as the namespace.

2. Otherwise:

(a) If $\langle\text{path}\rangle$ is empty, then $\langle\text{name}\rangle$ must have been declared earlier in the same file and retrievable from $\backslash\text{g_stex_modules_in_file_seq}$, or a file with name $\langle\text{name}\rangle.\langle\text{lang}\rangle.\text{tex}$ must exist in the top **source** folder of the archive, containing a module $\langle\text{name}\rangle$.

That module should lie directly in the namespace of the archive.

(b) If $\langle\text{path}\rangle$ is not empty, it must point to the path of the containing file as well as the namespace, relative to the namespace of the archive.

If a module by that namespace exists, it is returned. Otherwise, we call $\backslash\text{stex_require_module:nn}$ on the **source** directory of the archive to find the file.

$\backslash\text{l_stex_import_name_str}$ $\backslash\text{l_stex_import_archive_str}$ $\backslash\text{l_stex_import_path_str}$ $\backslash\text{l_stex_import_ns_str}$	stores the result in these four variables.
---	--

$\backslash\text{stex_import_require_module:nnnn}$	$\{\langle\text{ns}\rangle\}$ $\{\langle\text{archive-ID}\rangle\}$ $\{\langle\text{path}\rangle\}$ $\{\langle\text{name}\rangle\}$
---	---

Checks whether a module with URI $\langle\text{ns}\rangle?\langle\text{name}\rangle$ already exists. If not, it looks for a plausible file that declares a module with that URI.

Finally, activates that module by executing its `_code`-macro.

Chapter 15

$\text{\texttt{S}}\text{\texttt{T}}\text{\texttt{E}}\text{\texttt{X}}$ -Symbols

Code related to symbol declarations and notations

15.1 Macros and Environments

$\text{\texttt{\textbackslash symdecl}}$	$\text{\texttt{\textbackslash symdecl}}\{\langle\textit{macroname}\rangle\}[\langle\textit{args}\rangle]$
--	---

Declares a new symbol with semantic macro $\text{\texttt{\textbackslash macroname}}$. Optional arguments are:

- **name**: An (OMDOC) name. By default equal to $\langle\textit{macroname}\rangle$.
- **type**: An (ideally semantic) term, representing a *type*. Not used by $\text{\texttt{S}}\text{\texttt{T}}\text{\texttt{E}}\text{\texttt{X}}$, but passed on to MMT for semantic services.
- **def**: An (ideally semantic) term, representing a *definiens*. Not used by $\text{\texttt{S}}\text{\texttt{T}}\text{\texttt{E}}\text{\texttt{X}}$, but passed on to MMT for semantic services.
- **args**: Specifies the “signature” of the semantic macro. Can be either an integer $0 \leq n \leq 9$, or a (more precise) sequence of the following characters:
 - i** a “normal” argument, e.g. $\text{\texttt{\textbackslash symdecl}}\{\texttt{plus}}\}[\texttt{args=ii}]$ allows for $\text{\texttt{\textbackslash plus}}\{2\}\{2\}$.
 - a** an *associative* argument; i.e. a sequence of arbitrarily many arguments provided as a comma-separated list, e.g. $\text{\texttt{\textbackslash symdecl}}\{\texttt{plus}}\}[\texttt{args=a}]$ allows for $\text{\texttt{\textbackslash plus}}\{2,2,2\}$.
 - b** a *variable* argument. Is treated by $\text{\texttt{S}}\text{\texttt{T}}\text{\texttt{E}}\text{\texttt{X}}$ like an **i**-argument, but an application is turned into an $\text{\texttt{OMBind}}$ in OMDOC, binding the provided variable in the subsequent arguments of the operator; e.g. $\text{\texttt{\textbackslash symdecl}}\{\texttt{forall}}\}[\texttt{args=bi}]$ allows for $\text{\texttt{\textbackslash forall}}\{x\}\text{\texttt{\textbackslash in}}\{\texttt{Nat}}\}\{x\geq 0\}$.

<hr/> <hr/> <code>\stex_symdecl_do:n</code>	<p>Implements the core functionality of <code>\symdecl</code>, and is called by <code>\symdecl</code> and <code>\symdef</code>.</p> <p>Ultimately stores the symbol $\langle URI \rangle$ in the property list <code>\l_stex_symdecl_<URI>_prop</code> with fields:</p> <ul style="list-style-type: none"> • <code>name</code> (string), • <code>module</code> (string), • <code>notations</code> (sequence of strings; initially empty), • <code>type</code> (token list), • <code>args</code> (string of is, as and bs), • <code>arity</code> (integer string), • <code>assocs</code> (integer string; number of associative arguments),
<hr/> <hr/> <code>\stex_all_symbols:n</code>	<p>Iterates over all currently available symbols. Requires two <code>\seq_map_break:</code> to break fully.</p>
<hr/> <hr/> <code>\stex_get_symbol:n</code>	<p>Computes the full URI of a symbol from a macro argument, e.g. the macro name, the macro itself, the full URI...</p>
<hr/> <hr/> <code>\notation</code>	<p><code>\notation[<args>]{<symbol>}{<notations⁺>}</code></p> <p>Introduces a new notation for $\langle symbol \rangle$, see <code>\stex_notation_do:nn</code></p>
<hr/> <hr/> <code>\stex_notation_do:nn</code>	<p><code>\stex_notation_do:nn{<URI>}{<notations⁺>}</code></p> <p>Implements the core functionality of <code>\notation</code>, and is called by <code>\notation</code> and <code>\symdef</code>.</p> <p>Ultimately stores the notation in the property list <code>\g_stex_notation_<URI>#<variant>#<lang>_prop</code> with fields:</p> <ul style="list-style-type: none"> • <code>symbol</code> (URI string), • <code>language</code> (string), • <code>variant</code> (string), • <code>opprec</code> (integer string), • <code>argprec</code> (sequence of integer strings)
<hr/> <hr/> <code>\symdef</code>	<p><code>\symdef[<args>]{<symbol>}{<notations⁺>}</code></p> <p>Combines <code>\symdecl</code> and <code>\notation</code> by introducing a new symbol and assigning a new notation for it.</p>

Chapter 16

STEX-Terms

Code related to symbolic expressions, typesetting notations, notation components, etc.

16.1 Macros and Environments

<code>\STEXsymbol</code>	Uses <code>\stex_get_symbol:n</code> to find the symbol denoted by the first argument and passes the result on to <code>\stex_invoke_symbol:n</code>
--------------------------	--

<code>\symref</code>	<code>\symref{<symbol>}{<text>}</code> shortcut for <code>\STEXsymbol{<symbol>}! [<text>]</code>
----------------------	---

<code>\stex_invoke_symbol:n</code>	Executes a semantic macro. Outside of math mode or if followed by <code>*</code> , it continues to <code>\stex_term_custom:nn</code> . In math mode, it uses the default or optionally provided notation of the associated symbol.
------------------------------------	--

If followed by `!`, it will invoke the symbol *itself* rather than its application (and continue to `\stex_term_custom:nn`), i.e. it allows to refer to `\plus![addition]` as an operation, rather than `\plus[addition of]{some}{terms}`.

<code>\STEXInternalTermMathOMSiiii</code>	<code><URI><fragment><precedence><body></code>
<code>\STEXInternalTermMathOMAiiai</code>	
<code>\STEXInternalTermMathOMBiiii</code>	

Annotates `<body>` as an OMDOC-term (OMID, OMA or OMBIND, respectively) with head symbol `<URI>`, generated by the specific notation `<fragment>` with (upwards) operator precedence `<precedence>`. Inserts parentheses according to the current downwards precedence and operator precedence.

<code>\STEXInternalTermMathArgiii</code>	<code>\stex_term_arg:nnn<int><prec><body></code>
--	--

Annotates `<body>` as the `<int>`th argument of the current OMA or OMBIND, with (downwards) argument precedence `<prec>`.

<hr/> <code>\STEXInternalTermMathAssocArgiiii</code> <hr/>	<code>\stex_term_arg:nnn⟨int⟩⟨prec⟩⟨notation⟩⟨type⟩⟨body⟩</code>
	Annotates $\langle body \rangle$ as the $\langle int \rangle$ th (associative) <i>sequence</i> argument (as comma-separated list of terms) of the current OMA or OMBIND, with (downwards) argument precedence $\langle prec \rangle$ and associative notation $\langle notation \rangle$.
<hr/> <code>\infpref</code> <code>\neginfpref</code> <hr/>	Maximal and minimal notation precedences.
<hr/> <code>\dobrackets</code> <hr/>	<code>\dobrackets {⟨body⟩}</code> Puts $\langle body \rangle$ in parentheses; scaled if in display mode unscaled otherwise. Uses the current \TeX brackets (by default (and)), which can be changed temporarily using <code>\withbrackets</code> .
<hr/> <code>\withbrackets</code> <hr/>	<code>\withbrackets ⟨left⟩ ⟨right⟩ {⟨body⟩}</code> Temporarily (i.e. within $\langle body \rangle$) sets the brackets used by \TeX for automated bracketing (by default (and)) to $\langle left \rangle$ and $\langle right \rangle$. Note that $\langle left \rangle$ and $\langle right \rangle$ need to be allowed after <code>\left</code> and <code>\right</code> in display-mode.
<hr/> <code>\stex_term_custom:nn</code> <hr/>	<code>\stex_term_custom:nn{⟨URI⟩}{⟨args⟩}</code> Implements custom one-time notation. Invoked by <code>\stex_invoke_symbol:n</code> in text mode, or if followed by <code>*</code> in math mode, or whenever followed by <code>!</code> .
<hr/> <code>\comp</code> <code>\compemph</code> <code>\compemph@uri</code> <code>\defemph</code> <code>\defemph@uri</code> <code>\symrefemph</code> <code>\symrefemph@uri</code> <code>\varemp</code> <code>\varemp@uri</code> <hr/>	<code>\comp{⟨args⟩}</code> Marks $\langle args \rangle$ as a notation component of the current symbol for highlighting, linking, etc. The precise behavior is governed by <code>\@comp</code> , which takes as additional argument the URI of the current symbol. By default, <code>\@comp</code> adds the URI as a PDF tooltip and colors the highlighted part in blue. <code>\@defemph</code> behaves like <code>\@comp</code> , and can be similarly redefined, but marks an expression as <i>definiendum</i> (used by <code>\definiendum</code>)
<hr/> <code>\STEXinvisible</code> <hr/>	Exports its argument as OMDOC (invisible), but does not produce PDF output. Useful e.g. for semantic macros that take arguments that are not part of the symbolic notation.
<hr/> <code>\ellipses</code> <hr/>	TODO

Chapter 17

TeX-Structural Features

Code related to structural features

17.1 Macros and Environments

17.1.1 Structures

`mathstructure` (*env.*) TODO

Chapter 18

ST_EX-Statements

Code related to statements, e.g. definitions, theorems

18.1 Macros and Environments

`symboldoc (env.) \begin{<symboldoc>}{<symbols>}{<text> \end{<symboldoc>}}`

Declares *<text>* to be a (natural language, encyclopaedic) description of $\{<symbols>\}$ (a comma separated list of symbol identifiers).

Chapter 19

sTeX-Proofs: Structural Markup for Proofs

Chapter 20

sT_EX-Metatheory

20.1 Symbols

Part III
Extensions

Chapter 21

Tikzinput: Treating TIKZ code as images

21.1 Macros and Environments

Chapter 22

document-structure: Semantic Markup for Open Mathematical Documents in L^AT_EX

Chapter 23

NotesSlides – Slides and Course Notes

Chapter 24

`problem.sty`: An Infrastructure for formatting Problems

Chapter 25

**hwexam.sty/cls: An
Infrastructure for formatting
Assignments and Exams**

Part IV
Implementation

Chapter 26

\TeX -Basics Implementation

26.1 The \TeX Document Class

The `stex` document class is pretty straight-forward: It largely extends the `standalone` package and loads the `stex` package, passing all provided options on to the package.

```
1 <*cls>
2
3 %%%%%%%%% basics.dtx %%%%%%%%%
4
5 \RequirePackage{expl3,l3keys2e}
6 \ProvidesExplClass{stex}{2022/09/14}{3.2.0}{sTeX document class}
7
8 \DeclareOption*{\PassOptionsToPackage{\CurrentOption}{stex}}
9 \ProcessOptions
10
11 \bool_set_true:N \c_stex_document_class_bool
12
13 \RequirePackage{stex}
14
15 \stex_html_backend:TF {
16   \LoadClass{article}
17 }{
18   \LoadClass[border=1px,varwidth,crop=false]{standalone}
19   \setlength\textwidth{15cm}
20 }
21 \RequirePackage{standalone}
22
23
24 \clist_if_empty:NT \c_stex_languages_clist {
25   \seq_get_right:NN \g_stex_currentfile_seq \l_tmpa_str
26   \seq_set_split:NnV \l_tmpa_seq . \l_tmpa_str
27   \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str % .tex
28   \exp_args:No \str_if_eq:nnF \l_tmpa_str {tex} {
29     \exp_args:No \str_if_eq:nnF \l_tmpa_str {dtx} {
30       \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq \l_tmpa_str
```



```

31     }
32   }
33   \seq_pop_left:NN \l_tmpa_seq \l_tmpa_str % <filename>
34   \seq_if_empty:NF \l_tmpa_seq { %remaining element should be [<something>.]language
35     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
36     \prop_if_in:NoT \c_stex_languages_prop \l_tmpa_str {
37       \stex_debug:nn{language} {Language~\l_tmpa_str~
38         inferred~from~file~name}
39     }
40   }
41 }
42 }
43 </cls>

```

26.2 Preliminaries

```

44 <*package>
45
46 %%%%%%%%% basics.dtx %%%%%%%%%
47
48 \RequirePackage{expl3,l3keys2e,ltxcmds}
49 \ProvidesExplPackage{stex}{2022/09/14}{3.2.0}{sTeX package}
50
51 \bool_if_exist:NF \c_stex_document_class_bool {
52   \bool_set_false:N \c_stex_document_class_bool
53   \RequirePackage{standalone}
54 }
55
56 \message{^^J*~This~is~sTeX~version~3.2.0~*^^J}
57
58 %\RequirePackage{morewrites}
59 %\RequirePackage{amsmath}
60
61 Package options:
62 \keys_define:nn { stex } {
63   debug      .clist_set:N = \c_stex_debug_clist ,
64   lang       .clist_set:N = \c_stex_languages_clist ,
65   mathhub    .tl_set_x:N = \mathhub ,
66   usesms     .bool_set:N = \c_stex_persist_mode_bool ,
67   writesms   .bool_set:N = \c_stex_persist_write_mode_bool ,
68   image      .bool_set:N = \c_tikzinput_image_bool ,
69   unknown    .code:n      = {}
70 }
71 \ProcessKeysOptions { stex }

```

\stex The sTeX logo:

\sTeX `\RequirePackage{stex-logo}` % externalized for backwards-compatibility reasons

(End definition for \stex and \sTeX. These functions are documented on page 76.)

26.3 Messages and logging

```

72 <@@=stex_log>
    Warnings and error messages
73 \msg_new:nnn{stex}{error/unknownlanguage}{
74   Unknown~language:~#1
75 }
76 \msg_new:nnn{stex}{warning/nomathhub}{
77   MATHHUB~system~variable~not~found~and~no~
78   \detokenize{\mathhub}~value~set!
79 }
80 \msg_new:nnn{stex}{error/deactivated-macro}{
81   The~\detokenize{#1}~command~is~only~allowed~in~#2!
82 }

```

\stex_debug:nn A simple macro issuing package messages with subpath.

```

83 \cs_new_protected:Nn \stex_debug:nn {
84   \clist_if_in:NnTF \c_stex_debug_clist { all } {
85     \msg_set:nnn{stex}{debug / #1}{
86       \\Debug~#1:~#2\\
87     }
88     \msg_none:nn{stex}{debug / #1}
89   }{
90     \clist_if_in:NnT \c_stex_debug_clist { #1 } {
91       \msg_set:nnn{stex}{debug / #1}{
92         \\Debug~#1:~#2\\
93       }
94       \msg_none:nn{stex}{debug / #1}
95     }
96   }
97 }

```

(End definition for \stex_debug:nn. This function is documented on page 76.)

Redirecting messages:

```

98 \clist_if_in:NnTF \c_stex_debug_clist {all} {
99   \msg_redirect_module:nnn{ stex }{ none }{ term }
100 }{
101   \clist_map_inline:Nn \c_stex_debug_clist {
102     \msg_redirect_name:nnn{ stex }{ debug / #1 }{ term }
103   }
104 }
105
106 \stex_debug:nn{log}{debug~mode~on}

```

26.4 HTML Annotations

```

107 <@@=stex_annotate>

```

\l_stex_html_arg_tl Used by annotation macros to ensure that the HTML output to annotate is not empty.
\c_stex_html_emptyarg_tl

```

108 \tl_new:N \l_stex_html_arg_tl

```

(End definition for \l_stex_html_arg_tl and \c_stex_html_emptyarg_tl. These variables are documented on page ??.)

`_stex_html_checkempty:n`

```

109 \cs_new_protected:Nn \_stex_html_checkempty:n {
110   \tl_set:Nn \l_stex_html_arg_tl { #1 }
111   \tl_if_empty:NT \l_stex_html_arg_tl {
112     \tl_set_eq:NN \l_stex_html_arg_tl \c_stex_html_emptyarg_tl
113   }
114 }

```

(End definition for `_stex_html_checkempty:n`. This function is documented on page ??.)

`\stex_if_do_html_p:` Whether to (locally) produce HTML output

`\stex_if_do_html:TF`

```

115 \bool_new:N \_stex_html_do_output_bool
116 \bool_set_true:N \_stex_html_do_output_bool
117
118 \prg_new_conditional:Nnn \stex_if_do_html: {p,T,F,TF} {
119   \bool_if:nTF \_stex_html_do_output_bool
120     \prg_return_true: \prg_return_false:
121 }

```

(End definition for `\stex_if_do_html:TF`. This function is documented on page 76.)

`\stex_suppress_html:n` Whether to (locally) produce HTML output

```

122 \cs_new_protected:Nn \stex_suppress_html:n {
123   \exp_args:Nne \use:nn {
124     \bool_set_false:N \_stex_html_do_output_bool
125     #1
126   }{
127     \stex_if_do_html:T {
128       \bool_set_true:N \_stex_html_do_output_bool
129     }
130   }
131 }

```

(End definition for `\stex_suppress_html:n`. This function is documented on page 76.)

`\stex_annotate_html:nn`

`\stex_annotate_invisible:n`

`\stex_annotate_invisible:nnn`

We define four macros for introducing attributes in the HTML output. The definitions depend on the “backend” used (L^AT_EX_ML, R_US_TE_X, p_DF_LA_TE_X).

The p_DF_LA_TE_X-macros largely do nothing; the R_US_TE_X-implementations are pretty clear in what they do, the L^AT_EX_ML-implementations resort to perl bindings.

```

132 \ifcsname if@rustex\endcsname\else
133   \expandafter\newif\csname if@rustex\endcsname
134   \@rustexfalse
135 \fi
136 \ifcsname if@latexml\endcsname\else
137   \expandafter\newif\csname if@latexml\endcsname
138   \@latexmlfalse
139 \fi
140 \tl_if_exist:NF\stex@backend{
141   \if@rustex
142     \def\stex@backend{rustex}
143   \else
144     \if@latexml
145       \def\stex@backend{latexml}
146     \else

```

```

147     \cs_if_exist:NTF\HCode{
148       \def\stex@backend{tex4ht}
149     }{
150       \def\stex@backend{pdflatex}
151     }
152     \fi
153     \fi
154   }
155   \input{stex-backend-\stex@backend.cfg}
156
157   \newif\ifstexhtml
158   \stex_html_backend:TF\stexhtmltrue\stexhtmlfalse
159

```

(End definition for `\stex_annotate:nnn`, `\stex_annotate_invisible:n`, and `\stex_annotate_invisible:nnn`. These functions are documented on page 77.)

26.5 Babel Languages

```

160 <@=stex_language>

```

`\c_stex_languages_prop`
`\c_stex_language_abbrevs_prop`

We store language abbreviations in two (mutually inverse) property lists:

```

161 \exp_args:NNx \prop_const_from_keyval:Nn \c_stex_languages_prop { \tl_to_str:n {
162   en = english ,
163   de = ngerman ,
164   ar = arabic ,
165   bg = bulgarian ,
166   ru = russian ,
167   fi = finnish ,
168   ro = romanian ,
169   tr = turkish ,
170   fr = french
171 }}
172
173 \exp_args:NNx \prop_const_from_keyval:Nn \c_stex_language_abbrevs_prop { \tl_to_str:n {
174   english   = en ,
175   ngerman   = de ,
176   arabic    = ar ,
177   bulgarian = bg ,
178   russian   = ru ,
179   finnish   = fi ,
180   romanian  = ro ,
181   turkish   = tr ,
182   french    = fr
183 }}
184 % todo: chinese simplified (zhs)
185 %       chinese traditional (zht)

```

(End definition for `\c_stex_languages_prop` and `\c_stex_language_abbrevs_prop`. These variables are documented on page 77.)

we use the `lang`-package option to load the corresponding babel languages:

```

186 \cs_new_protected:Nn \stex_set_language:Nn {
187   \str_set:Nx \l_tmpa_str {#2}
188   \prop_get:NoNT \c_stex_languages_prop \l_tmpa_str #1 {

```

```

189 \ifx\@onlypreamble\@notprerr
190 \ltx@ifpackageloaded{babel}{
191   \exp_args:No \selectlanguage #1
192 }{}
193 \else
194   \exp_args:No \str_if_eq:nnTF #1 {turkish} {
195     \RequirePackage[#1,shorthands=:!]{babel}
196   }{
197     \RequirePackage[#1]{babel}
198   }
199 \fi
200 }
201 }
202
203 \clist_if_empty:NF \c_stex_languages_clist {
204   \bool_set_false:N \l_tmpa_bool
205   \clist_clear:N \l_tmpa_clist
206   \clist_map_inline:Nn \c_stex_languages_clist {
207     \str_set:Nx \l_tmpa_str {#1}
208     \str_if_eq:nnT {#1}{tr}{
209       \bool_set_true:N \l_tmpa_bool
210     }
211     \prop_get:NoNTF \c_stex_languages_prop \l_tmpa_str \l_tmpa_str {
212       \clist_put_right:No \l_tmpa_clist \l_tmpa_str
213     } {
214       \msg_error:nnx{stex}{error/unknownlanguage}{\l_tmpa_str}
215     }
216   }
217   \stex_debug:nn{lang} {Languages:~\clist_use:Nn \l_tmpa_clist {,~} }
218   \bool_if:NTF \l_tmpa_bool {
219     \RequirePackage[\clist_use:Nn \l_tmpa_clist,,shorthands=:!]{babel}
220   }{
221     \RequirePackage[\clist_use:Nn \l_tmpa_clist,]{babel}
222   }
223 }
224
225 \AtBeginDocument{
226   \stex_html_backend:T {
227     \seq_get_right:NN \g_stex_currentfile_seq \l_tmpa_str
228     \seq_set_split:NnV \l_tmpa_seq . \l_tmpa_str
229     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str % .tex
230     \seq_pop_left:NN \l_tmpa_seq \l_tmpa_str % <filename>
231     \seq_if_empty:NF \l_tmpa_seq { %remaining element should be language
232       \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
233       \stex_debug:nn{basics} {Language~\l_tmpa_str~
234         inferred~from~file~name}
235       \stex_annotate_invisible:nnn{language}{ \l_tmpa_str }{}
236     }
237   }
238 }
239

```

26.6 Persistence

```

240 <@@=stex_persist>
241 \bool_if:NTF \c_stex_persist_mode_bool {
242   \def \stex_persist:n #1 {}
243   \def \stex_persist:x #1 {}
244 }{
245   \bool_if:NTF \c_stex_persist_write_mode_bool {
246     \iow_new:N \c__stex_persist_iow
247     \iow_open:Nn \c__stex_persist_iow{\jobname.sms}
248     \AtEndDocument{
249       \iow_close:N \c__stex_persist_iow
250     }
251     \cs_new_protected:Nn \stex_persist:n {
252       \tl_set:Nn \l_tmpa_tl { #1 }
253       \regex_replace_all:nnN { \cP\# } { \cO\# } \l_tmpa_tl
254       \regex_replace_all:nnN { \ } { \~ } \l_tmpa_tl
255       \exp_args:NNo \iow_now:Nn \c__stex_persist_iow \l_tmpa_tl
256     }
257     \cs_generate_variant:Nn \stex_persist:n {x}
258   }{
259     \def \stex_persist:n #1 {}
260     \def \stex_persist:x #1 {}
261   }
262 }

```

26.7 Auxiliary Methods

\stex_deactivate_macro:Nn

```

263 \cs_new_protected:Nn \stex_deactivate_macro:Nn {
264   \exp_after:wN\let\csname \detokenize{#1} - orig\endcsname#1
265   \def#1{
266     \msg_error:nnnn{stex}{error/deactivated-macro}{\detokenize{#1}}{#2}
267   }
268 }

```

(End definition for \stex_deactivate_macro:Nn. This function is documented on page 77.)

\stex_reactivate_macro:N

```

269 \cs_new_protected:Nn \stex_reactivate_macro:N {
270   \exp_after:wN\let\exp_after:wN#1\csname \detokenize{#1} - orig\endcsname
271 }

```

(End definition for \stex_reactivate_macro:N. This function is documented on page 77.)

\ignorespacesandpars

```

272 \protected\def\ignorespacesandpars{
273   \begingroup\catcode13=10\relax
274   \@ifnextchar\par{
275     \endgroup\expandafter\ignorespacesandpars\@gobble
276   }{
277     \endgroup
278   }
279 }

```

```

280
281 \cs_new_protected:Nn \stex_copy_control_sequence:NNN {
282   \tl_set:Nx \_tmp_args_tl {\cs_argument_spec:N #2}
283   \exp_args:NNo \tl_remove_all:Nn \_tmp_args_tl \c_hash_str
284   \int_set:Nn \l_tmpa_int {\tl_count:N \_tmp_args_tl}
285
286   \tl_clear:N \_tmp_args_tl
287   \int_step_inline:nn \l_tmpa_int {
288     \tl_put_right:Nx \_tmp_args_tl {{\exp_not:n{####}\exp_not:n{##1}}}
289   }
290
291   \tl_set:Nn #3 {\cs_generate_from_arg_count:NNnn #1 \cs_set:Npn}
292   \tl_put_right:Nx #3 { {\int_use:N \l_tmpa_int}{
293     \exp_after:wN\exp_after:wN\exp_after:wN \exp_not:n
294     \exp_after:wN\exp_after:wN\exp_after:wN\exp_after:wN {
295       \exp_after:wN #2 \_tmp_args_tl
296     }
297   }}
298 }
299 \cs_generate_variant:Nn \stex_copy_control_sequence:NNN {cNN}
300 \cs_generate_variant:Nn \stex_copy_control_sequence:NNN {NcN}
301 \cs_generate_variant:Nn \stex_copy_control_sequence:NNN {ccN}
302
303 \cs_new_protected:Nn \stex_copy_control_sequence_ii:NNN {
304   \tl_set:Nx \_tmp_args_tl {\cs_argument_spec:N #2}
305   \exp_args:NNo \tl_remove_all:Nn \_tmp_args_tl \c_hash_str
306   \int_set:Nn \l_tmpa_int {\tl_count:N \_tmp_args_tl}
307
308   \tl_clear:N \_tmp_args_tl
309   \int_step_inline:nn \l_tmpa_int {
310     \tl_put_right:Nx \_tmp_args_tl {{\exp_not:n{#####}\exp_not:n{##1}}}
311   }
312
313   \edef \_tmp_args_tl {
314     \exp_after:wN\exp_after:wN\exp_after:wN \exp_not:n
315     \exp_after:wN\exp_after:wN\exp_after:wN {
316       \exp_after:wN #2 \_tmp_args_tl
317     }
318   }
319
320   \exp_after:wN \def \exp_after:wN \_tmp_args_tl
321   \exp_after:wN ##\exp_after:wN 1 \exp_after:wN ##\exp_after:wN 2
322   \exp_after:wN { \_tmp_args_tl }
323
324   \edef \_tmp_args_tl {
325     \exp_after:wN \exp_not:n \exp_after:wN {
326       \_tmp_args_tl {####1}{####2}
327     }
328   }
329
330   \tl_set:Nn #3 {\cs_generate_from_arg_count:NNnn #1 \cs_set:Npn}
331   \tl_put_right:Nx #3 { {\int_use:N \l_tmpa_int}{
332     \exp_after:wN\exp_not:n\exp_after:wN{\_tmp_args_tl}
333   }}

```

```

334 }
335
336 \cs_generate_variant:Nn \stex_copy_control_sequence_ii:NNN {cNN}
337 \cs_generate_variant:Nn \stex_copy_control_sequence_ii:NNN {NcN}
338 \cs_generate_variant:Nn \stex_copy_control_sequence_ii:NNN {ccN}

```

(End definition for \ignorespacesandpars. This function is documented on page 77.)

\MMTrule

```

339 \NewDocumentCommand \MMTrule {m m}{
340   \seq_set_split:Nnn \l_tmpa_seq , {#2}
341   \int_zero:N \l_tmpa_int
342   \stex_annotate_invisible:nnn{mmtrule}{scala://#1}{
343     \seq_if_empty:NF \l_tmpa_seq {
344       $\seq_map_inline:Nn \l_tmpa_seq {
345         \int_incr:N \l_tmpa_int
346         \stex_annotate:nnn{arg}{i\int_use:N \l_tmpa_int}{##1}
347       }$
348     }
349   }
350 }
351
352 \NewDocumentCommand \MMTinclude {m}{
353   \stex_annotate_invisible:nnn{import}{#1}{-}
354 }
355
356 \tl_new:N \g_stex_document_title
357 \cs_new_protected:Npn \STEXTtitle #1 {
358   \tl_if_empty:NT \g_stex_document_title {
359     \tl_gset:Nn \g_stex_document_title { #1 }
360   }
361 }
362 \cs_new_protected:Nn \stex_document_title:n {
363   \tl_if_empty:NT \g_stex_document_title {
364     \tl_gset:Nn \g_stex_document_title { #1 }
365     \stex_annotate_invisible:n{\noindent
366       \stex_annotate:nnn{doctitle}{-}{ #1 }
367     \par}
368   }
369 }
370 \AtBeginDocument {
371   \let \STEXTtitle \stex_document_title:n
372   \tl_if_empty:NF \g_stex_document_title {
373     \stex_annotate_invisible:n{\noindent
374       \stex_annotate:nnn{doctitle}{-}{ \g_stex_document_title }
375     \par}
376   }
377   \let \stex_maketitle:\maketitle
378   \def \maketitle{
379     \tl_if_empty:NF \@title {
380       \exp_args:No \stex_document_title:n \@title
381     }
382     \stex_maketitle:
383   }

```



```

384 }
385
386 \let\STEXInternalAnnotate\stex_annotate:nnn
387
388 \cs_new_protected:Nn \stex_par: {
389   \mode_if_vertical:F{
390     \if@minipage\else\if@nobreak\else\par\fi\fi
391   }
392 }
393
394 \cs_new_protected:Nn \__stex_persist_patchcounter:n{
395   \cs_set_eq:cc{\__stex_persist_tmp_#1}{@#1}
396   \cs_set:cpn {@#1} ##1 {
397     \STEXInternalAnnotate{counter}{
398       \expandafter\expandafter\expandafter
399       \expandafter\expandafter\expandafter
400       \expandafter\@gobble
401       \expandafter\expandafter\expandafter\@gobble
402       \expandafter\@gobble\detokenize{##1},
403       #1,\number##1}{\use:c{\__stex_persist_tmp_#1}{##1}}
404   }
405 }
406
407 \cs_new_protected:Nn \stex_patch_counters: {
408   \__stex_persist_patchcounter:n{arabic}
409   \__stex_persist_patchcounter:n{roman}
410   \__stex_persist_patchcounter:n{Roman}
411   \__stex_persist_patchcounter:n{alph}
412   \__stex_persist_patchcounter:n{Alph}
413   \__stex_persist_patchcounter:n{fnsymbol}
414   \let\__stex_persist_tmp_refstepcounter\refstepcounter
415   \cs_set:Npn\refstepcounter##1{
416     \__stex_persist_tmp_refstepcounter{##1}
417     \STEXInternalAnnotate{stepcounter}{##1}{ }
418   }
419 }
420
421 \cs_new_protected:Nn \stex_unpatch_counters: {
422   \let\@arabic\__stex_persist_tmp_arabic
423   \let\@roman\__stex_persist_tmp_roman
424   \let\@Roman\__stex_persist_tmp_Roman
425   \let\@alph\__stex_persist_tmp_alph
426   \let\@Alph\__stex_persist_tmp_Alph
427   \let\@fnsymbol\__stex_persist_tmp_fnsymbol
428   \let\refstepcounter\__stex_persist_tmp_refstepcounter
429 }
430
431 %\AtBeginDocument{
432 %}
433
434 </package>

```

(End definition for \MMTrule. This function is documented on page ??.)

Chapter 27

STEX -MathHub Implementation

```
435 <*package>
436
437 %%%%%%%%%% mathhub.dtx %%%%%%%%%%
438
439 <@@=stex_path>
440
441 Warnings and error messages
442 \msg_new:nnn{stex}{error/norepository}{
443   No~archive~#1~found~in~#2
444 }
445 \msg_new:nnn{stex}{error/notinarchive}{
446   Not~currently~in~an~archive,~but~\detokenize{#1}~
447   needs~one!
448 }
449 \msg_new:nnn{stex}{error/nofile}{
450   \detokenize{#1}~could~not~find~file~#2
451 }
452 \msg_new:nnn{stex}{error/twofiles}{
453   \detokenize{#1}~found~two~candidates~for~#2
454 }
```

27.1 Generic Path Handling

We treat paths as L^AT_EX3-sequences (of the individual path segments, i.e. separated by a /-character) unix-style; i.e. a path is absolute if the sequence starts with an empty entry.

`\stex_path_from_string:Nn`

```
453 \cs_new_protected:Nn \stex_path_from_string:Nn {
454   \stex_debug:nn{files}{#2}
455   \str_set:Nx \l_tmpa_str { #2 }
456   \str_if_empty:NTF \l_tmpa_str {
457     \seq_clear:N #1
458   }{
459     \exp_args:NNNo \seq_set_split:Nnn #1 / { \l_tmpa_str }
460     \sys_if_platform_windows:T{
```

```

461     \seq_clear:N \l_tmpa_tl
462     \seq_map_inline:Nn #1 {
463         \seq_set_split:Nnn \l_tmpb_tl \c_backslash_str { ##1 }
464         \seq_concat:NNN \l_tmpa_tl \l_tmpa_tl \l_tmpb_tl
465     }
466     \seq_set_eq:NN #1 \l_tmpa_tl
467 }
468 \stex_path_canonicalize:N #1
469 }
470 \stex_debug:nn{files}{Yields: \stex_path_to_string:N#1}
471 }
472

```

(End definition for `\stex_path_from_string:Nn`. This function is documented on page 78.)

`\stex_path_to_string:NN`
`\stex_path_to_string:N`

```

473 \cs_new_protected:Nn \stex_path_to_string:NN {
474     \exp_args:NNe \str_set:Nn #2 { \seq_use:Nn #1 / }
475 }
476
477 \cs_new:Nn \stex_path_to_string:N {
478     \seq_use:Nn #1 /
479 }

```

(End definition for `\stex_path_to_string:NN` and `\stex_path_to_string:N`. These functions are documented on page 78.)

`\c__stex_path_dot_str` . and .., respectively.
`\c__stex_path_up_str`

```

480 \str_const:Nn \c__stex_path_dot_str {.}
481 \str_const:Nn \c__stex_path_up_str {..}

```

(End definition for `\c__stex_path_dot_str` and `\c__stex_path_up_str`.)

`\stex_path_canonicalize:N` Canonicalizes the path provided; in particular, resolves . and .. path segments.

```

482 \cs_new_protected:Nn \stex_path_canonicalize:N {
483     \stex_debug:nn{paths}{canonicalizing~\seq_use:Nn #1 /}
484     \bool_set_false:N \l__stex_path_in_path_bool
485     \seq_if_empty:NF #1 {
486         \seq_clear:N \l_tmpa_seq
487         \seq_get_left:NN #1 \l_tmpa_tl
488         \str_if_empty:NT \l_tmpa_tl {
489             \seq_put_right:Nn \l_tmpa_seq {}
490         }
491         \seq_map_inline:Nn #1 {
492             \str_set:Nn \l_tmpa_tl { ##1 }
493             \str_if_eq:NnF \l_tmpa_tl \c__stex_path_dot_str {
494                 \str_if_eq:NNTF \l_tmpa_tl \c__stex_path_up_str {
495                     \bool_set_true:N \l__stex_path_in_path_bool
496                     \seq_if_empty:NNTF \l_tmpa_seq {
497                         \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
498                             \c__stex_path_up_str
499                         }
500                     }{
501                         \seq_get_right:NN \l_tmpa_seq \l_tmpa_tl

```

```

502         \str_if_eq:NNTF \l_tmpa_tl \c__stex_path_up_str {
503             \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
504                 \c__stex_path_up_str
505             }
506         }{
507             \seq_pop_right:NN \l_tmpa_seq \l_tmpb_tl
508         }
509     }
510 }{
511     \str_if_empty:NTF \l_tmpa_tl {
512         \bool_if:NT \l__stex_path_in_path_bool {
513             \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq { \l_tmpa_tl }
514         }
515     } {
516         \bool_set_true:N \l__stex_path_in_path_bool
517         \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq { \l_tmpa_tl }
518     }
519 }
520 }
521 }
522 \seq_gset_eq:NN #1 \l_tmpa_seq
523 \stex_debug:nn{paths}{...returns~\seq_use:Nn #1 /}
524 }
525 }

```

(End definition for `\stex_path_canonicalize:N`. This function is documented on page 78.)

`\stex_path_if_absolute_p:N`
`\stex_path_if_absolute:N`**TF**

```

526 \prg_new_conditional:Nnn \stex_path_if_absolute:N {p, T, F, TF} {
527     \seq_if_empty:NTF #1 {
528         \prg_return_false:
529     }{
530         \seq_get_left:NN #1 \l_tmpa_tl
531         \sys_if_platform_windows:TF{
532             \str_if_in:NnTF \l_tmpa_tl {:}{
533                 \prg_return_true:
534             }{
535                 \prg_return_false:
536             }
537         }{
538             \str_if_empty:NTF \l_tmpa_tl {
539                 \prg_return_true:
540             }{
541                 \prg_return_false:
542             }
543         }
544     }
545 }

```

(End definition for `\stex_path_if_absolute:N`. This function is documented on page 78.)

27.2 PWD and kpsewhich

`\stex_kpsewhich:n`

```

546 \str_new:N\l_stex_kpsewhich_return_str
547 \cs_new_protected:Nn \stex_kpsewhich:n {\begingroup
548   \catcode'\ =12
549   \sys_get_shell:nnN { kpsewhich ~ #1 } { } \l_tmpa_tl
550   \tl_gset_eq:NN \l_tmpa_tl \l_tmpa_tl
551   \endgroup
552   \exp_args:NNo\str_set:Nn\l_stex_kpsewhich_return_str{\l_tmpa_tl}
553   \tl_trim_spaces:N \l_stex_kpsewhich_return_str
554 }

```

(End definition for `\stex_kpsewhich:n`. This function is documented on page 78.)

We determine the PWD

`\c_stex_pwd_seq`
`\c_stex_pwd_str`

```

555 \sys_if_platform_windows:TF{
556   \begingroup\escapechar=-1\catcode'\ =12
557   \exp_args:Nx\stex_kpsewhich:n{-expand-var~\c_percent_str CD\c_percent_str}
558   \exp_args:NNx\str_replace_all:Nnn\l_stex_kpsewhich_return_str{\c_backslash_str}/
559   \exp_args:Nnx\use:nn{\endgroup}{\str_set:Nn\exp_not:N\l_stex_kpsewhich_return_str{\l_stex_
560   }}{
561     \stex_kpsewhich:n{-var-value~PWD}
562   }
563
564 \stex_path_from_string:Nn\c_stex_pwd_seq\l_stex_kpsewhich_return_str
565 \stex_path_to_string:NN\c_stex_pwd_seq\c_stex_pwd_str
566 \stex_debug:nn {mathhub} {PWD:~\str_use:N\c_stex_pwd_str}

```

(End definition for `\c_stex_pwd_seq` and `\c_stex_pwd_str`. These variables are documented on page 78.)

27.3 File Hooks and Tracking

```

567 <@@=stex_files>

```

We introduce hooks for file inputs that keep track of the absolute paths of files used. This will be useful to keep track of modules, their archives, namespaces etc.

Note that the absolute paths are only accurate in `\input`-statements for paths relative to the PWD, so they shouldn't be relied upon in any other setting than for \TeX -purposes.

`\g__stex_files_stack` keeps track of file changes

```

568 \seq_gclear_new:N\g__stex_files_stack

```

(End definition for `\g__stex_files_stack`.)

`\c_stex_mainfile_seq`
`\c_stex_mainfile_str`

```

569 \str_set:Nx \c_stex_mainfile_str {\c_stex_pwd_str/\jobname.tex}
570 \stex_path_from_string:Nn \c_stex_mainfile_seq
571   \c_stex_mainfile_str

```

(End definition for `\c_stex_mainfile_seq` and `\c_stex_mainfile_str`. These variables are documented on page 78.)

`\g_stex_currentfile_seq`

```

572 \seq_gclear_new:N\g_stex_currentfile_seq

```

(End definition for `\g_stex_currentfile_seq`. This variable is documented on page 79.)

`\stex_filestack_push:n`

```

573 \cs_new_protected:Nn \stex_filestack_push:n {
574   \stex_path_from_string:Nn\g_stex_currentfile_seq{#1}
575   \stex_path_if_absolute:NF\g_stex_currentfile_seq{
576     \stex_path_from_string:Nn\g_stex_currentfile_seq{
577       \c_stex_pwd_str/#1
578     }
579   }
580   \seq_gset_eq:NN\g_stex_currentfile_seq\g_stex_currentfile_seq
581   \exp_args:NNo\seq_gpush:Nn\g__stex_files_stack\g_stex_currentfile_seq
582   \stex_get_document_uri:
583 }

```

(End definition for `\stex_filestack_push:n`. This function is documented on page 79.)

`\stex_filestack_pop:`

```

584 \cs_new_protected:Nn \stex_filestack_pop: {
585   \seq_if_empty:NF\g__stex_files_stack{
586     \seq_gpop:NN\g__stex_files_stack\l_tmpa_seq
587   }
588   \seq_if_empty:NTF\g__stex_files_stack{
589     \seq_gset_eq:NN\g_stex_currentfile_seq\c_stex_mainfile_seq
590   }{
591     \seq_get:NN\g__stex_files_stack\l_tmpa_seq
592     \seq_gset_eq:NN\g_stex_currentfile_seq\l_tmpa_seq
593   }
594   \stex_get_document_uri:
595 }

```

(End definition for `\stex_filestack_pop:`. This function is documented on page 79.)

Hooks for the current file:

```

596 \AddToHook{file/before}{
597   \tl_if_empty:NTF\CurrentFilePath{
598     \stex_filestack_push:n{\CurrentFile}
599   }{
600     \stex_filestack_push:n{\CurrentFilePath/\CurrentFile}
601   }
602 }
603 \AddToHook{file/after}{
604   \stex_filestack_pop:
605 }

```

27.4 MathHub Repositories

606 `<@=stex_mathhub>`

`\mathhub`
`\c_stex_mathhub_seq`
`\c_stex_mathhub_str`

The path to the mathhub directory. If the `\mathhub`-macro is not set, we query `kpsewhich` for the `MATHHUB` system variable.

```

607 \str_if_empty:NTF\mathhub{
608   \sys_if_platform_windows:TF{
609     \begingroup\escapechar=-1\catcode'\=12

```

```

610 \exp_args:Nx\stex_kpsewhich:n{-expand-var~\c_percent_str MATHHUB\c_percent_str}
611 \exp_args:NNx\str_replace_all:Nnn\l_stex_kpsewhich_return_str{\c_backslash_str}/
612 \exp_args:NNx\str_if_eq:ont\l_stex_kpsewhich_return_str{\c_percent_str MATHHUB\c_percent
613 \exp_args:Nnx\use:nn{\endgroup}{\str_set:Nn\exp_not:N\l_stex_kpsewhich_return_str{\l_st
614 }{
615 \stex_kpsewhich:n{-var-value-MATHHUB}
616 }
617 \str_set_eq:NN\c_stex_mathhub_str\l_stex_kpsewhich_return_str
618
619 \str_if_empty:NT \c_stex_mathhub_str {
620 \sys_if_platform_windows:TF{
621 \begingroup\escapechar=-1\catcode'\=12
622 \exp_args:Nx\stex_kpsewhich:n{-var-value-HOME}
623 \exp_args:NNx\str_replace_all:Nnn\l_stex_kpsewhich_return_str{\c_backslash_str}/
624 \exp_args:Nnx\use:nn{\endgroup}{\str_set:Nn\exp_not:N\l_stex_kpsewhich_return_str{\l_s
625 }{
626 \stex_kpsewhich:n{-var-value-HOME}
627 }
628 \ior_open:NnT \g_tmpa_ior{\l_stex_kpsewhich_return_str / .stex / mathhub.path}{
629 \begingroup\escapechar=-1\catcode'\=12
630 \ior_str_get:NN \g_tmpa_ior \l_tmpa_str
631 \sys_if_platform_windows:T{
632 \exp_args:NNx\str_replace_all:Nnn\l_tmpa_str{\c_backslash_str}/
633 }
634 \str_gset_eq:NN \c_stex_mathhub_str\l_tmpa_str
635 \endgroup
636 \ior_close:N \g_tmpa_ior
637 }
638 }
639 \str_if_empty:NTF\c_stex_mathhub_str{
640 \msg_warning:nn{stex}{warning/nomathhub}
641 }{
642 \stex_debug:nn{mathhub}{MathHub:~\str_use:N\c_stex_mathhub_str}
643 \exp_args:NNo \stex_path_from_string:Nn\c_stex_mathhub_seq\c_stex_mathhub_str
644 }
645 }{
646 \stex_path_from_string:Nn \c_stex_mathhub_seq \mathhub
647 \stex_path_if_absolute:NF \c_stex_mathhub_seq {
648 \exp_args:NNx \stex_path_from_string:Nn \c_stex_mathhub_seq {
649 \c_stex_pwd_str/\mathhub
650 }
651 }
652 \stex_path_to_string:NN\c_stex_mathhub_seq\c_stex_mathhub_str
653 \stex_debug:nn{mathhub}{MathHub:~\str_use:N\c_stex_mathhub_str}
654 }

```

(End definition for `\mathhub`, `\c_stex_mathhub_seq`, and `\c_stex_mathhub_str`. These variables are documented on page 79.)

`_stex_mathhub_do_manifest:n` Checks whether the manifest for archive #1 already exists, and if not, finds and parses the corresponding manifest file

```

655 \cs_new_protected:Nn \_stex_mathhub_do_manifest:n {
656 \prop_if_exist:cF {c_stex_mathhub_#1_manifest_prop} {
657 \str_set:Nx \l_tmpa_str { #1 }

```

```

658 \prop_new:c { c_stex_mathhub_#1_manifest_prop }
659 \seq_set_split:NnV \l_tmpa_seq / \l_tmpa_str
660 \seq_concat:NNN \l_tmpa_seq \c_stex_mathhub_seq \l_tmpa_seq
661 \__stex_mathhub_find_manifest:N \l_tmpa_seq
662 \seq_if_empty:NTF \l__stex_mathhub_manifest_file_seq {
663   \msg_error:nnxx{stex}{error/norepository}{#1}{
664     \stex_path_to_string:N \c_stex_mathhub_str
665   }
666   \input{Fatal-Error!}
667 } {
668   \exp_args:No \__stex_mathhub_parse_manifest:n { \l_tmpa_str }
669 }
670 }
671 }

```

(End definition for __stex_mathhub_do_manifest:n.)

\l_stex_mathhub_manifest_file_seq

```

672 \seq_new:N\l__stex_mathhub_manifest_file_seq

```

(End definition for \l__stex_mathhub_manifest_file_seq.)

__stex_mathhub_find_manifest:N Attempts to find the MANIFEST.MF in some file path and stores its path in \l__stex_mathhub_manifest_file_seq:

```

673 \cs_new_protected:Nn \__stex_mathhub_find_manifest:N {
674   \seq_set_eq:NN\l_tmpa_seq #1
675   \bool_set_true:N\l_tmpa_bool
676   \bool_while_do:Nn \l_tmpa_bool {
677     \seq_if_empty:NTF \l_tmpa_seq {
678       \bool_set_false:N\l_tmpa_bool
679     }{
680       \file_if_exist:nTF{
681         \stex_path_to_string:N\l_tmpa_seq/MANIFEST.MF
682       }{
683         \seq_put_right:Nn\l_tmpa_seq{MANIFEST.MF}
684         \bool_set_false:N\l_tmpa_bool
685       }{
686         \file_if_exist:nTF{
687           \stex_path_to_string:N\l_tmpa_seq/META-INF/MANIFEST.MF
688         }{
689           \seq_put_right:Nn\l_tmpa_seq{META-INF}
690           \seq_put_right:Nn\l_tmpa_seq{MANIFEST.MF}
691           \bool_set_false:N\l_tmpa_bool
692         }{
693           \file_if_exist:nTF{
694             \stex_path_to_string:N\l_tmpa_seq/meta-inf/MANIFEST.MF
695           }{
696             \seq_put_right:Nn\l_tmpa_seq{meta-inf}
697             \seq_put_right:Nn\l_tmpa_seq{MANIFEST.MF}
698             \bool_set_false:N\l_tmpa_bool
699           }{
700             \seq_pop_right:NN\l_tmpa_seq\l_tmpa_tl
701           }
702         }

```



```

703     }
704   }
705 }
706 \seq_set_eq:NN \l__stex_mathhub_manifest_file_seq \l_tmpa_seq
707 }

```

(End definition for __stex_mathhub_find_manifest:N.)

\c__stex_mathhub_manifest_ior File variable used for MANIFEST-files

```

708 \ior_new:N \c__stex_mathhub_manifest_ior

```

(End definition for \c__stex_mathhub_manifest_ior.)

__stex_mathhub_parse_manifest:n Stores the entries in manifest file in the corresponding property list:

```

709 \cs_new_protected:Nn \__stex_mathhub_parse_manifest:n {
710   \seq_set_eq:NN \l_tmpa_seq \l__stex_mathhub_manifest_file_seq
711   \ior_open:Nn \c__stex_mathhub_manifest_ior {\stex_path_to_string:N \l_tmpa_seq}
712   \ior_map_inline:Nn \c__stex_mathhub_manifest_ior {
713     \str_set:Nn \l_tmpa_str {##1}
714     \exp_args:NNoo \seq_set_split:Nnn
715       \l_tmpb_seq \c_colon_str \l_tmpa_str
716     \seq_pop_left:NNTF \l_tmpb_seq \l_tmpa_tl {
717       \exp_args:NNe \str_set:Nn \l_tmpb_tl {
718         \exp_args:NNo \seq_use:Nn \l_tmpb_seq \c_colon_str
719       }
720       \exp_args:No \str_case:nnTF \l_tmpa_tl {
721         {id} {
722           \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
723             { id } \l_tmpb_tl
724         }
725         {narration-base} {
726           \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
727             { narr } \l_tmpb_tl
728         }
729         {url-base} {
730           \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
731             { docurl } \l_tmpb_tl
732         }
733         {source-base} {
734           \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
735             { ns } \l_tmpb_tl
736         }
737         {ns} {
738           \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
739             { ns } \l_tmpb_tl
740         }
741         {dependencies} {
742           \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
743             { deps } \l_tmpb_tl
744         }
745       }{}{}
746     }{}
747   }
748   \ior_close:N \c__stex_mathhub_manifest_ior

```

```

749 \stex_persist:x {
750   \prop_set_from_keyval:cn{ c_stex_mathhub_#1_manifest_prop }{
751     \exp_after:wN \prop_to_keyval:N \csname c_stex_mathhub_#1_manifest_prop\endcsname
752   }
753 }
754 }

```

(End definition for `__stex_mathhub_parse_manifest:n`.)

`\stex_set_current_repository:n`

```

755 \cs_new_protected:Nn \stex_set_current_repository:n {
756   \stex_require_repository:n { #1 }
757   \prop_set_eq:Nc \l_stex_current_repository_prop {
758     c_stex_mathhub_#1_manifest_prop
759   }
760 }

```

(End definition for `\stex_set_current_repository:n`. This function is documented on page 79.)

`\stex_require_repository:n`

```

761 \cs_new_protected:Nn \stex_require_repository:n {
762   \prop_if_exist:cF { c_stex_mathhub_#1_manifest_prop } {
763     \stex_debug:nn{mathhub}{Opening~archive:~#1}
764     \__stex_mathhub_do_manifest:n { #1 }
765   }
766 }

```

(End definition for `\stex_require_repository:n`. This function is documented on page 79.)

`\l_stex_current_repository_prop` Current MathHub repository

```

767 %\prop_new:N \l_stex_current_repository_prop
768 \bool_if:NF \c_stex_persist_mode_bool {
769   \__stex_mathhub_find_manifest:N \c_stex_pwd_seq
770   \seq_if_empty:NTF \l__stex_mathhub_manifest_file_seq {
771     \stex_debug:nn{mathhub}{Not~currently~in~a~MathHub~repository}
772   } {
773     \__stex_mathhub_parse_manifest:n { main }
774     \prop_get:NnN \c_stex_mathhub_main_manifest_prop {id}
775     \l_tmpa_str
776     \prop_set_eq:cN { c_stex_mathhub_\l_tmpa_str_manifest_prop }
777     \c_stex_mathhub_main_manifest_prop
778     \exp_args:Nx \stex_set_current_repository:n { \l_tmpa_str }
779     \stex_debug:nn{mathhub}{Current~repository:~
780       \prop_item:Nn \l_stex_current_repository_prop {id}
781     }
782   }
783 }

```

(End definition for `\l_stex_current_repository_prop`. This variable is documented on page 79.)

`\stex_in_repository:nn` Executes the code in the second argument in the context of the repository whose ID is provided as the first argument.

```

784 \cs_new_protected:Nn \stex_in_repository:nn {
785   \str_set:Nx \l_tmpa_str { #1 }
786   \cs_set:Npn \l_tmpa_cs ##1 { #2 }

```

```

787 \str_if_empty:NTF \l_tmpa_str {
788   \prop_if_exist:NTF \l_stex_current_repository_prop {
789     \stex_debug:nn{mathhub}{do~in~current~repository:~\prop_item:Nn \l_stex_current_reposi
790     \exp_args:Ne \l_tmpa_cs{
791       \prop_item:Nn \l_stex_current_repository_prop { id }
792     }
793   }{
794     \l_tmpa_cs{}
795   }
796 }{
797   \stex_debug:nn{mathhub}{in~repository:~\l_tmpa_str}
798   \stex_require_repository:n \l_tmpa_str
799   \str_set:Nx \l_tmpa_str { #1 }
800   \exp_args:Nne \use:nn {
801     \stex_set_current_repository:n \l_tmpa_str
802     \exp_args:Nx \l_tmpa_cs{\l_tmpa_str}
803   }{
804     \stex_debug:nn{mathhub}{switching~back~to:~
805     \prop_if_exist:NTF \l_stex_current_repository_prop {
806       \prop_item:Nn \l_stex_current_repository_prop { id }::~
807     \meaning\l_stex_current_repository_prop
808     }{
809       no~repository
810     }
811   }
812   \prop_if_exist:NTF \l_stex_current_repository_prop {
813     \stex_set_current_repository:n {
814       \prop_item:Nn \l_stex_current_repository_prop { id }
815     }
816   }{
817     \let\exp_not:N\l_stex_current_repository_prop\exp_not:N\undefined
818   }
819 }
820 }
821 }

```

(End definition for `\stex_in_repository:nn`. This function is documented on page 79.)

27.5 Using Content in Archives

`\mhpath`

```

822 \def \mhpath #1 #2 {
823   \exp_args:Ne \tl_if_empty:NTF{#1}{
824     \c_stex_mathhub_str /
825     \prop_item:Nn \l_stex_current_repository_prop { id }
826     / source / #2
827   }{
828     \c_stex_mathhub_str / #1 / source / #2
829   }
830 }

```

(End definition for `\mhpath`. This function is documented on page 80.)

`\inputref`
`\mhinput`

```

831 \newif \ifinputref \inputreffalse
832
833 \cs_new_protected:Nn \__stex_mathhub_mhinput:nn {
834   \stex_in_repository:nn {#1} {
835     \ifinputref
836       \input{ \c_stex_mathhub_str / ##1 / source / #2 }
837     \else
838       \inputreftrue
839       \input{ \c_stex_mathhub_str / ##1 / source / #2 }
840       \inputreffalse
841     \fi
842   }
843 }
844 \NewDocumentCommand \mhinput { 0{} m}{
845   \__stex_mathhub_mhinput:nn{ #1 }{ #2 }
846 }
847
848 \cs_new_protected:Nn \__stex_mathhub_inputref:nn {
849   \stex_in_repository:nn {#1} {
850     \stex_html_backend:TF {
851       \str_clear:N \l_tmpa_str
852       \prop_get:NnNF \l_stex_current_repository_prop { narr } \l_tmpa_str {
853         \prop_get:NnNF \l_stex_current_repository_prop { ns } \l_tmpa_str {}
854       }
855
856       \tl_if_empty:nTF{ ##1 }{
857         \IfFileExists{#2}{
858           \stex_annotate_invisible:nnn{inputref}{
859             \l_tmpa_str / #2
860           }{}
861         }{
862           \input{#2}
863         }
864       }{
865         \IfFileExists{ \c_stex_mathhub_str / ##1 / source / #2 }{
866           \stex_annotate_invisible:nnn{inputref}{
867             \l_tmpa_str / #2
868           }{}
869         }{
870           \input{ \c_stex_mathhub_str / ##1 / source / #2 }
871         }
872       }
873
874     }{
875       \begingroup
876       \inputreftrue
877       \tl_if_empty:nTF{ ##1 }{
878         \input{#2}
879       }{
880         \input{ \c_stex_mathhub_str / ##1 / source / #2 }
881       }
882       \endgroup
883     }

```

```

884 }
885 }
886 \NewDocumentCommand \inputref { 0{ } m }{
887   \__stex_mathhub_inputref:nn{ #1 }{ #2 }
888 }

```

(End definition for `\inputref` and `\mhinput`. These functions are documented on page 80.)

`\addmhbibresource`

```

889 \cs_new_protected:Nn \__stex_mathhub_mhbibresource:nn {
890   \stex_in_repository:nn {#1} {
891     \addbibresource{ \c_stex_mathhub_str / ##1 / #2 }
892   }
893 }
894 \newcommand\addmhbibresource[2] []{
895   \__stex_mathhub_mhbibresource:nn{ #1 }{ #2 }
896 }

```

(End definition for `\addmhbibresource`. This function is documented on page 80.)

`\libinput`

```

897 \cs_new_protected:Npn \libinput #1 {
898   \prop_if_exist:NF \l_stex_current_repository_prop {
899     \msg_error:nnn{stex}{error/notinarchive}\libinput
900   }
901   \prop_get:NnNF \l_stex_current_repository_prop {id} \l_tmpa_str {
902     \msg_error:nnn{stex}{error/notinarchive}\libinput
903   }
904   \seq_clear:N \l__stex_mathhub_libinput_files_seq
905   \seq_set_eq:NN \l_tmpa_seq \c_stex_mathhub_seq
906   \seq_set_split:NnV \l_tmpb_seq / \l_tmpa_str
907
908   \bool_while_do:nn { ! \seq_if_empty_p:N \l_tmpb_seq }{
909     \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / meta-inf / lib / #1.tex}
910     \IfFileExists{ \l_tmpa_str }{
911       \seq_put_right:No \l__stex_mathhub_libinput_files_seq \l_tmpa_str
912     }{}
913     \seq_pop_left:NN \l_tmpb_seq \l_tmpa_str
914     \seq_put_right:No \l_tmpa_seq \l_tmpa_str
915   }
916
917   \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / lib / #1.tex}
918   \IfFileExists{ \l_tmpa_str }{
919     \seq_put_right:No \l__stex_mathhub_libinput_files_seq \l_tmpa_str
920   }{}
921
922   \seq_if_empty:NTF \l__stex_mathhub_libinput_files_seq {
923     \msg_error:nnxx{stex}{error/nofile}{\exp_not:N\libinput}{#1.tex}
924   }{
925     \seq_map_inline:Nn \l__stex_mathhub_libinput_files_seq {
926       \input{ ##1 }
927     }
928   }
929 }

```

(End definition for `\libinput`. This function is documented on page 80.)

`\libusepackage`

```

930 \NewDocumentCommand \libusepackage {0{} m} {
931   \prop_if_exist:NF \l_stex_current_repository_prop {
932     \msg_error:nnn{stex}{error/notinarchive}\libusepackage
933   }
934   \prop_get:NnNF \l_stex_current_repository_prop {id} \l_tmpa_str {
935     \msg_error:nnn{stex}{error/notinarchive}\libusepackage
936   }
937   \seq_clear:N \l__stex_mathhub_libinput_files_seq
938   \seq_set_eq:NN \l_tmpa_seq \c_stex_mathhub_seq
939   \seq_set_split:NnV \l_tmpb_seq / \l_tmpa_str
940
941   \bool_while_do:nn { ! \seq_if_empty_p:N \l_tmpb_seq }{
942     \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / meta-inf / lib / #2}
943     \IfFileExists{ \l_tmpa_str.sty }{
944       \seq_put_right:No \l__stex_mathhub_libinput_files_seq \l_tmpa_str
945     }{}
946     \seq_pop_left:NN \l_tmpb_seq \l_tmpa_str
947     \seq_put_right:No \l_tmpa_seq \l_tmpa_str
948   }
949
950   \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / lib / #2}
951   \IfFileExists{ \l_tmpa_str.sty }{
952     \seq_put_right:No \l__stex_mathhub_libinput_files_seq \l_tmpa_str
953   }{}
954
955   \seq_if_empty:NTF \l__stex_mathhub_libinput_files_seq {
956     \msg_error:nnxx{stex}{error/nofile}{\exp_not:N\libusepackage}{#2.sty}
957   }{
958     \int_compare:nNnTF {\seq_count:N \l__stex_mathhub_libinput_files_seq} = 1 {
959       \seq_map_inline:Nn \l__stex_mathhub_libinput_files_seq {
960         \usepackage[#1]{ ##1 }
961       }
962     }{
963       \msg_error:nnxx{stex}{error/twofiles}{\exp_not:N\libusepackage}{#2.sty}
964     }
965   }
966 }
```

(End definition for `\libusepackage`. This function is documented on page 80.)

`\mhgraphics`

`\cmhgraphics`

```

967
968 \AddToHook{begindocument}{
969   \ltx@ifpackageloaded{graphicx}{
970     \define@key{Gin}{mhrepos}{\def\Gin@mhrepos{#1}}
971     \providecommand\mhgraphics[2][]{%
972       \def\Gin@mhrepos{}\setkeys{Gin}{#1}%
973       \includegraphics[#1]{\mhp@h\Gin@mhrepos{#2}}}
974     \providecommand\cmhgraphics[2][]{\begin{center}\mhgraphics[#1]{#2}\end{center}}
975   }{}
```

(End definition for `\mhgraphics` and `\cmhgraphics`. These functions are documented on page 80.)

`\lstinputmhlisting`
`\clstinputmhlisting`

```
976 \ltx@ifpackageloaded{listings}{  
977   \define@key{lst}{mhrepos}{\def\lst@mhrepos{#1}}  
978   \newcommand\lstinputmhlisting[2][]{%  
979     \def\lst@mhrepos{}\setkeys{lst}{#1}%  
980     \lstinputlisting[#1]{\mhpath\lst@mhrepos{#2}}}  
981   \newcommand\clstinputmhlisting[2][]{\begin{center}\lstinputmhlisting[#1]{#2}\end{center}}  
982 }{}  
983 }  
984  
985 \end{package}
```

(End definition for `\lstinputmhlisting` and `\clstinputmhlisting`. These functions are documented on page 80.)

Chapter 28

STEX -References Implementation

```
986 <*package>
987
988 %%%%%%%%% stex-references.dtx %%%%%%%%%
989
990 <@@=stex_refs>
991
992   Warnings and error messages
993   \msg_new:nnn{stex}{error/extrefmissing}{
994     Missing~in~or~cite~value~for~\detokenize{\extref}!
995   }
996   \msg_new:nnn{stex}{warning/smsmissing}{
997     .sref~file~#1~doesn't~exist!
998   }
999   \msg_new:nnn{stex}{warning/smslabelmissing}{
1000     No~label~#2~in~.sref~file~#1!
1001   }
```

References are stored in the file `\jobname.sref`, to enable cross-referencing external documents.

```
1000 \iow_new:N \c__stex_refs_refs_iow
1001 \AtBeginDocument{
1002   \iow_open:Nn \c__stex_refs_refs_iow {\jobname.sref}
1003 }
1004 \AtEndDocument{
1005   \iow_close:N \c__stex_refs_refs_iow
1006 }
```

28.1 Document URIs and URLs

`\l_stex_current_docns_str`

```
1007 \str_new:N \l_stex_current_docns_str
```

(End definition for `\l_stex_current_docns_str`. This variable is documented on page 81.)

`\stex_get_document_uri:`

```
1008 \cs_new_protected:Nn \stex_get_document_uri: {
```



```

1009 \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
1010 \seq_pop_right:NN \l_tmpa_seq \l_tmpb_str
1011 \exp_args:NNno \seq_set_split:Nnn \l_tmpb_seq . \l_tmpb_str
1012 \seq_get_left:NN \l_tmpb_seq \l_tmpb_str
1013 \seq_put_right:No \l_tmpa_seq \l_tmpb_str
1014
1015 \str_clear:N \l_tmpa_str
1016 \prop_if_exist:NT \l_stex_current_repository_prop {
1017   \prop_get:NnNF \l_stex_current_repository_prop { narr } \l_tmpa_str {
1018     \prop_get:NnNF \l_stex_current_repository_prop { ns } \l_tmpa_str {}
1019   }
1020 }
1021
1022 \str_if_empty:NTF \l_tmpa_str {
1023   \str_set:Nx \l_stex_current_docns_str {
1024     file:/\stex_path_to_string:N \l_tmpa_seq
1025   }
1026 }{
1027   \bool_set_true:N \l_tmpa_bool
1028   \bool_while_do:Nn \l_tmpa_bool {
1029     \seq_pop_left:NN \l_tmpa_seq \l_tmpb_str
1030     \exp_args:No \str_case:nnTF { \l_tmpb_str } {
1031       {source} { \bool_set_false:N \l_tmpa_bool }
1032     }{}{
1033       \seq_if_empty:NT \l_tmpa_seq {
1034         \bool_set_false:N \l_tmpa_bool
1035       }
1036     }
1037   }
1038
1039   \seq_if_empty:NTF \l_tmpa_seq {
1040     \str_gset_eq:NN \l_stex_current_docns_str \l_tmpa_str
1041   }{
1042     \str_gset:Nx \l_stex_current_docns_str {
1043       \l_tmpa_str/\stex_path_to_string:N \l_tmpa_seq
1044     }
1045   }
1046 }
1047 %\stex_get_document_url:
1048 }

```

(End definition for `\stex_get_document_uri:`. This function is documented on page 81.)

`\l_stex_current_docurl_str`

```

1049 \str_new:N \l_stex_current_docurl_str

```

(End definition for `\l_stex_current_docurl_str`. This variable is documented on page 81.)

`\stex_get_document_url:`

```

1050 \cs_new_protected:Nn \stex_get_document_url: {
1051   \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
1052   \seq_pop_right:NN \l_tmpa_seq \l_tmpb_str
1053   \exp_args:NNno \seq_set_split:Nnn \l_tmpb_seq . \l_tmpb_str
1054   \seq_get_left:NN \l_tmpb_seq \l_tmpb_str
1055   \seq_put_right:No \l_tmpa_seq \l_tmpb_str

```

```

1056 \str_clear:N \l_tmpa_str
1057 \prop_if_exist:NT \l_stex_current_repository_prop {
1058   \prop_get:NnNF \l_stex_current_repository_prop { docurl } \l_tmpa_str {
1059     \prop_get:NnNF \l_stex_current_repository_prop { narr } \l_tmpa_str {
1060       \prop_get:NnNF \l_stex_current_repository_prop { ns } \l_tmpa_str {}
1061     }
1062   }
1063 }
1064 }
1065
1066 \str_if_empty:NTF \l_tmpa_str {
1067   \str_set:Nx \l_stex_current_docurl_str {
1068     file:/\stex_path_to_string:N \l_tmpa_seq
1069   }
1070 }{
1071   \bool_set_true:N \l_tmpa_bool
1072   \bool_while_do:Nn \l_tmpa_bool {
1073     \seq_pop_left:NN \l_tmpa_seq \l_tmpb_str
1074     \exp_args:No \str_case:nnTF { \l_tmpb_str } {
1075       {source} { \bool_set_false:N \l_tmpa_bool }
1076     }{}{
1077       \seq_if_empty:NT \l_tmpa_seq {
1078         \bool_set_false:N \l_tmpa_bool
1079       }
1080     }
1081   }
1082 }
1083 \seq_if_empty:NTF \l_tmpa_seq {
1084   \str_set_eq:NN \l_stex_current_docurl_str \l_tmpa_str
1085 }{
1086   \str_set:Nx \l_stex_current_docurl_str {
1087     \l_tmpa_str/\stex_path_to_string:N \l_tmpa_seq
1088   }
1089 }
1090 }
1091 }

```

(End definition for `\stex_get_document_url`.. This function is documented on page 81.)

28.2 Setting Reference Targets

```

1092 \str_const:Nn \c__stex_refs_url_str{URL}
1093 \str_const:Nn \c__stex_refs_ref_str{REF}
1094 \str_new:N \l__stex_refs_curr_label_str
1095 % @currentlabel -> number
1096 % @currentlabelname -> title
1097 % @currentHref -> name.number <- id of some kind
1098 % @currentcounter <- name/id
1099 % \#autorefname <- "Section"
1100 % \theH# -> \arabic{section}
1101 % \the# -> number
1102 % \hyper@makecurrent{#}
1103 \int_new:N \l__stex_refs_unnamed_counter_int

```

Restoring references from .sref-files

\STEXInternalSrefRestoreTarget

1104 \cs_new_protected:Npn \STEXInternalSrefRestoreTarget #1#2#3#4#5 {}

(End definition for \STEXInternalSrefRestoreTarget. This function is documented on page ??.)

\stex_ref_new_doc_target:n

```

1105 \seq_new:N \g_stex_ref_files_seq
1106
1107 \cs_new_protected:Nn \stex_ref_new_doc_target:n {
1108   %\stex_get_document_uri:
1109   \str_clear:N \l__stex_refs_curr_label_str
1110   \str_set:Nx \l_tmpa_str { #1 }
1111   \str_if_empty:NT \l_tmpa_str {
1112     \int_gincr:N \l__stex_refs_unnamed_counter_int
1113     \str_set:Nx \l_tmpa_str {REF\int_use:N \l__stex_refs_unnamed_counter_int}
1114   }
1115   \str_set:Nx \l__stex_refs_curr_label_str {
1116     \l_stex_current_docns_str?\l_tmpa_str
1117   }
1118
1119   \exp_args:Noo \STEXInternalAuxAddDocRef\l_stex_current_docns_str\l_tmpa_str
1120
1121   %\seq_if_exist:cF{g__stex_refs_labels_\l_tmpa_str_seq}{
1122   %   \seq_new:c {g__stex_refs_labels_\l_tmpa_str_seq}
1123   %}
1124   %\seq_if_in:coF{g__stex_refs_labels_\l_tmpa_str_seq}\l__stex_refs_curr_label_str {
1125   %   \seq_gput_right:co{g__stex_refs_labels_\l_tmpa_str_seq}\l__stex_refs_curr_label_str
1126   %}
1127
1128
1129   \stex_if_smsmode:TF {
1130     %\stex_get_document_url:
1131     %\str_gset_eq:cN {sref_url_\l__stex_refs_curr_label_str_str}\l_stex_current_docurl_str
1132     %\str_gset_eq:cN {sref_\l__stex_refs_curr_label_str_type}\c__stex_refs_url_str
1133   }{
1134     \iow_now:Nx \c__stex_refs_refs_iow {
1135       \STEXInternalSrefRestoreTarget
1136       {\l_stex_current_docns_str}
1137       {\l_tmpa_str}
1138       {\@currentcounter}
1139       {\@currentlabel}
1140       {\tl_if_exist:NT\@currentlabelname{\exp_args:No\unexpanded\@currentlabelname}}
1141     }
1142     %\iow_now:Nx \c__stex_refs_refs_iow {
1143     %   {\l_stex_current_docns_str?\l_tmpa_str}~=={\use:c{\@currentcounter autorefname}~\@currentlabel}
1144     %\stex_debug:nn{sref}{New~label~\l__stex_refs_curr_label_str~at~\use:c{\use:c{\@currentcounter}~\@currentlabel}}
1145     %\exp_args:Nx\label{sref_\l__stex_refs_curr_label_str}
1146     %\immediate\write\auxout{\STEXInternalAuxAddDocRef{\l_stex_current_docns_str}{\l_tmpa_str}{\l__stex_refs_curr_label_str}}
1147     %\str_gset:cx {sref_\l__stex_refs_curr_label_str_type}\c__stex_refs_ref_str
1148   }
1149 }
1150 \NewDocumentCommand \slabel {m} {\stex_ref_new_doc_target:n {#1}}

```

(End definition for `\stex_ref_new_doc_target:n`. This function is documented on page 81.)

The following is used to set the necessary macros in the `.aux`-file.

```

1151 \cs_new_protected:Npn \STEXInternalAuxAddDocRef #1 #2 {
1152   \exp_args:NNx \seq_if_in:NnTF \g_stex_ref_files_seq {\detokenize{#1}} {
1153     \exp_args:Nnx \seq_if_in:cnF{g_stex_ref_ #1 _seq}{\detokenize{#2}}{
1154       \exp_args:Nnx \seq_gput_left:cn{g_stex_ref_ #1 _seq}{\detokenize{#2}}
1155     }
1156   }{
1157     \exp_args:NNx \seq_gput_right:Nn \g_stex_ref_files_seq {\detokenize{#1}}
1158     %\seq_if_exist:cF{g_stex_ref_ #1 _seq}{
1159       \seq_new:c{g_stex_ref_ #1 _seq} % <- seq_new throws errors??
1160     %}
1161     \exp_args:Nnx \seq_gput_left:cn{g_stex_ref_ #1 _seq}{\detokenize{#2}}
1162   }
1163
1164   %\str_set:Nn \l_tmpa_str {#1?#2}
1165   %\str_gset_eq:cN{sref_#1?#2_type}\c__stex_refs_ref_str
1166   %\seq_if_exist:cF{g__stex_refs_labels_#2_seq}{
1167     % \seq_new:c {g__stex_refs_labels_#2_seq}
1168     %}
1169   %\seq_if_in:coF{g__stex_refs_labels_#2_seq}\l_tmpa_str {
1170     % \seq_gput_right:co{g__stex_refs_labels_#2_seq}\l_tmpa_str
1171     %}
1172 }

```

To avoid resetting the same macros when the `.aux`-file is read at the end of the document:

```

1173 \AtEndDocument{
1174   \def\STEXInternalAuxAddDocRef#1 #2 {}{}
1175 }

```

`\stex_ref_new_sym_target:n`

```

1176 \cs_new_protected:Nn \stex_ref_new_sym_target:n {
1177
1178   % \stex_if_smsmode:TF {
1179   %   \str_if_exist:cF{sref_sym_#1_type}{
1180   %     \stex_get_document_url:
1181   %     \str_gset_eq:cN {sref_sym_url_#1_str}\l_stex_current_docurl_str
1182   %     \str_gset_eq:cN {sref_sym_#1_type}\c__stex_refs_url_str
1183   %   }
1184   % }{
1185   %   \str_if_empty:NF \l__stex_refs_curr_label_str {
1186   %     \str_gset_eq:cN {sref_sym_#1_label_str}\l__stex_refs_curr_label_str
1187   %     \immediate\write\@auxout{
1188   %       \exp_not:N\expandafter\def\exp_not:N\csname \exp_not:N\detokenize{sref_sym_#1_label
1189   %         \l__stex_refs_curr_label_str
1190   %       }
1191   %     }
1192   %   }
1193   % }
1194 }

```

(End definition for `\stex_ref_new_sym_target:n`. This function is documented on page 81.)

28.3 Using References

`\sref` Optional arguments:

```

1195
1196 \keys_define:nn { stex / sref / 1 } {
1197   archive .str_set_x:N = \l__stex_refs_repo_str,
1198   file     .str_set_x:N = \l__stex_refs_file_str,
1199   % TODO get rid of this
1200   fallback .code:n = {},
1201   pre      .code:n = {},
1202   post     .code:n = {}
1203 }
1204 \cs_new_protected:Nn \__stex_refs_args_i:n {
1205   \str_clear:N \l__stex_refs_repo_str
1206   \str_clear:N \l__stex_refs_file_str
1207   \keys_set:nn { stex / sref / 1 } { #1 }
1208 }
1209 \keys_define:nn { stex / sref / 2 } {
1210   in .str_set_x:N = \l__stex_refs_in_str,
1211   archive .str_set_x:N = \l__stex_refs_repob_str,
1212   title .tl_set:N = \l__stex_refs_title_tl
1213 }
1214 \cs_new_protected:Nn \__stex_refs_args_ii:n {
1215   \str_clear:N \l__stex_refs_in_str
1216   \tl_clear:N \l__stex_refs_title_tl
1217   \str_clear:N \l__stex_refs_repob_str
1218   \keys_set:nn { stex / sref / 2 } { #1 }
1219 }

```

The actual macro:

```

1220 \NewDocumentCommand \sref { 0{} m 0{} }{
1221   \__stex_refs_args_i:n{#1}
1222   \__stex_refs_args_ii:n{#3}
1223   \str_clear:N \l__stex_refs_uri_str
1224   \__stex_refs_find_uri:n{#2}
1225   \__stex_refs_do_sref:n{#2}
1226 }
1227 \NewDocumentCommand \extref { 0{} m m }{
1228   \__stex_refs_args_i:n{#1}
1229   \__stex_refs_args_ii:n{#3}
1230   \str_if_empty:NT \l__stex_refs_in_str {
1231     \msg_error:nn{stex}{error/extrefmissing}
1232   }
1233   \str_clear:N \l__stex_refs_uri_str
1234   \__stex_refs_find_uri:n{#2}
1235   \__stex_refs_do_sref_in:n{#2}
1236 }
1237
1238 \cs_new_protected:Nn \__stex_refs_find_uri:n {
1239   \stex_debug:nn{sref}{File:~\l__stex_refs_file_str^^JRepo:\l__stex_refs_repo_str}
1240   \str_if_empty:NTF \l__stex_refs_file_str {
1241     \stex_debug:nn{sref}{Empty.~Checking~current~file~for~#1}
1242     \seq_if_exist:cT{g_stex_ref_\l_stex_current_docns_str_seq}{
1243       \seq_map_inline:cn{g_stex_ref_\l_stex_current_docns_str_seq}{

```

```

1244     \str_if_eq:nnT{#1}{##1}{
1245         \str_set_eq:NN \l__stex_refs_uri_str \l_stex_current_docns_str
1246         \stex_debug:nn{sref}{Found.}
1247         \seq_map_break:
1248     }
1249 }
1250 }
1251 \str_if_empty:NT \l__stex_refs_uri_str {
1252     \stex_debug:nn{sref}{Checking~other~files}
1253     \seq_map_inline:Nn \g_stex_ref_files_seq {
1254         \stex_debug:nn{sref}{##1...}
1255         \seq_map_inline:cn{g_stex_ref_##1_seq}{
1256             \str_if_eq:nnT{#1}{####1}{
1257                 \stex_debug:nn{sref}{Found~##1}
1258                 \str_set:Nn \l__stex_refs_uri_str {##1}
1259                 \seq_map_break:n{\seq_map_break:}
1260             }
1261         }
1262     }
1263 }
1264 }{
1265     \str_if_empty:NTF \l__stex_refs_repo_str {
1266         \prop_if_exist:NTF \l_stex_current_repository_prop {
1267             \stex_debug:nn{sref}{in~archive~\prop_item:Nn \l_stex_current_repository_prop { id }
1268             \prop_get:NnN \l_stex_current_repository_prop { ns } \l__stex_refs_uri_str
1269             \stex_debug:nn{sref}{namespace:~\l__stex_refs_uri_str}
1270             \str_set:Nx \l__stex_refs_uri_str {\l__stex_refs_uri_str / \l__stex_refs_file_str}
1271             \stex_path_from_string:Nn \l_tmpb_seq \l__stex_refs_uri_str
1272             \str_set:Nx \l__stex_refs_uri_str {\stex_path_to_string:N \l_tmpb_seq}
1273             \stex_debug:nn{sref}{Return:~\l__stex_refs_uri_str}
1274         }{
1275             \stex_debug:nn{sref}{Not~in~archive}
1276             \stex_path_from_string:Nn \l_tmpb_seq {
1277                 \stex_path_to_string:N \g_stex_currentfile_seq/ .. / \l__stex_refs_file_str
1278             }
1279             \str_set:Nx \l__stex_refs_uri_str {file:~\stex_path_to_string:N \l_tmpb_seq}
1280         }
1281     }{
1282         \stex_require_repository:n \l__stex_refs_repo_str
1283         \prop_get:cnN { c_stex_mathhub \l__stex_refs_repo_str _manifest_prop } { ns } \l__stex
1284         \str_set:Nx \l__stex_refs_uri_str {\l__stex_refs_uri_str / \l__stex_refs_file_str}
1285         \stex_path_from_string:Nn \l_tmpb_seq \l__stex_refs_uri_str
1286         \str_set:Nx \l__stex_refs_uri_str {\stex_path_to_string:N \l_tmpb_seq}
1287     }
1288 }
1289 }
1290
1291 \cs_new_protected:Nn \__stex_refs_do_autoref:n{
1292     \cs_if_exist:cTF{autoref}{
1293         \exp_args:Nx\autoref{sref_#1}
1294     }{
1295         \exp_args:Nx\ref{sref_#1}
1296     }
1297 }

```

```

1298
1299 \cs_new_protected:Nn \__stex_refs_do_sref:n {
1300   \str_if_empty:NTF \l__stex_refs_uri_str {
1301     \str_if_empty:NTF \l__stex_refs_in_str {
1302       \stex_debug:nn{sref}{autoref-on-#1}
1303       \__stex_refs_do_autoref:n{#1}
1304     }{
1305       \stex_debug:nn{sref}{srefin-on-#1}
1306       \__stex_refs_do_sref_in:n{#1}
1307     }
1308   }{
1309     \exp_args:NNo \seq_if_in:NnTF \g_stex_ref_files_seq \l__stex_refs_uri_str {
1310       \exp_args:Nnx \seq_if_in:cnTF{g_stex_ref\_l__stex_refs_uri_str_seq}{\detokenize{#1}}{
1311         \stex_debug:nn{sref}{Reference-found-in-ref-files;~autoref-on~\l__stex_refs_uri_str?#1}
1312         \__stex_refs_do_autoref:n{\l__stex_refs_uri_str?#1}
1313       }{
1314         \str_if_empty:NTF \l__stex_refs_in_str {
1315           \stex_debug:nn{sref}{in-empty;~autoref-on~\l__stex_refs_uri_str?#1}
1316           \__stex_refs_do_autoref:n{\l__stex_refs_uri_str?#1}
1317         }{
1318           \stex_debug:nn{sref}{in-non-empty;~srefin-on~\l__stex_refs_uri_str?#1}
1319           \__stex_refs_do_sref_in:n{#1}
1320         }
1321       }
1322     }{
1323       \str_if_empty:NTF \l__stex_refs_in_str {
1324         \stex_debug:nn{sref}{in-empty;~autoref-on~\l__stex_refs_uri_str?#1}
1325         \__stex_refs_do_autoref:n{\l__stex_refs_uri_str?#1}
1326       }{
1327         \stex_debug:nn{sref}{in-non-empty;~srefin-on~\l__stex_refs_uri_str?#1}
1328         \__stex_refs_do_sref_in:n{#1}
1329       }
1330     }
1331   }
1332 }
1333
1334 \cs_new_protected:Nn \__stex_refs_restore_target:nnnnn {
1335   \str_if_empty:NTF \l__stex_refs_uri_str {
1336     \exp_args:No \str_if_eq:nnT \l__stex_refs_id_str {#2}{
1337       \tl_set:Nn \l__stex_refs_return_tl {
1338         \use:c{#3autorefname}~#4\tl_if_empty:nF{#5}{~(5)}~in~
1339         \tl_if_empty:NTF\l__stex_refs_title_tl{
1340           ???
1341         }\l__stex_refs_title_tl
1342       }
1343     }
1344   }{
1345     \stex_debug:nn{sref}{\l__stex_refs_uri_str{~ == ~ #1 ~ ?}}
1346     \exp_args:No \str_if_eq:nnT \l__stex_refs_uri_str {#1}{
1347       \stex_debug:nn{sref}{\l__stex_refs_id_str~ == ~ #2 ~ ?}}
1348     \exp_args:No \str_if_eq:nnT \l__stex_refs_id_str {#2}{
1349       \stex_debug:nn{sref}{success!}
1350       \tl_set:Nn \l__stex_refs_return_tl {
1351         \use:c{#3autorefname}~#4\tl_if_empty:nF{#5}{~(5)}~in~

```

```

1352         \tl_if_empty:nTF\l__stex_refs_title_tl{
1353             ???
1354         }\l__stex_refs_title_tl
1355     }
1356     \endinput
1357 }
1358 }
1359 }
1360 }
1361
1362 \cs_new_protected:Nn \__stex_refs_do_sref_in:n {
1363     \stex_debug:nn{sref}{In: \l__stex_refs_in_str^^JRepo:\l__stex_refs_repo_str}
1364     \stex_debug:nn{sref}{URI: \l__stex_refs_uri_str?#1}
1365     %\msg_warning:nnn{stex}{warning/smsmissing}{<filename>}
1366     \begin_group\catcode13=9\relax\catcode10=9\relax
1367     \str_if_empty:NTF \l__stex_refs_repob_str {
1368         \prop_if_exist:NTF \l_stex_current_repository_prop {
1369             \str_set:Nx \l_tmpa_str {
1370                 \c_stex_mathhub_str /
1371                 \prop_item:Nn \l_stex_current_repository_prop { id }
1372                 / source / \l__stex_refs_in_str .sref
1373             }
1374         }{
1375             \str_set:Nx \l_tmpa_str {
1376                 \stex_path_to_string:N \g_stex_currentfile_seq/ .. / \l__stex_refs_in_str . sref
1377             }
1378         }
1379     }{
1380         \str_set:Nx \l_tmpa_str {
1381             \c_stex_mathhub_str / \l__stex_refs_repob_str
1382             / source / \l__stex_refs_in_str . sref
1383         }
1384     }
1385     \stex_path_from_string:Nn \l_tmpb_seq \l_tmpa_str
1386     \stex_path_to_string:NN \l_tmpb_seq \l_tmpa_str
1387     \stex_debug:nn{sref}{File: \l_tmpa_str}
1388     \exp_args:No \IfFileExists \l_tmpa_str {
1389         \tl_clear:N \l__stex_refs_return_tl
1390         \str_set:Nn \l__stex_refs_id_str {#1}
1391         \let\STEXInternalSrefRestoreTarget\__stex_refs_restore_target:nnnnn
1392         \use:c{@ @ input}{\l_tmpa_str}
1393         \exp_args:No \tl_if_empty:nTF \l__stex_refs_return_tl {
1394             \exp_args:Nnno \msg_warning:nnnn{stex}{warning/smslabelmissing}\l_tmpa_str{#1}
1395             \__stex_refs_do_autoref:n{
1396                 \str_if_empty:NF\l__stex_refs_uri_str{\l__stex_refs_uri_str?}#1
1397             }
1398         }{
1399             \l__stex_refs_return_tl
1400         }
1401     }{
1402         \exp_args:Nnno \msg_warning:nnn{stex}{warning/smsmissing}\l_tmpa_str
1403         \__stex_refs_do_autoref:n{
1404             \str_if_empty:NF\l__stex_refs_uri_str{\l__stex_refs_uri_str?}#1
1405         }
1406     }

```



```

1406     }
1407 \endgroup
1408 }
1409
1410 % \__stex_refs_args:n { #1 }
1411 % \str_if_empty:NTF \l__stex_refs_indocument_str {
1412 %   \str_set:Nx \l_tmpa_str { #2 }
1413 %   \exp_args:NNno \seq_set_split:Nnn \l_tmpa_seq ? \l_tmpa_str
1414 %   \int_compare:nNnTF {\seq_count:N \l_tmpa_seq} = 1 {
1415 %     \seq_if_exist:cTF{g__stex_refs_labels_\l_tmpa_str_seq}{
1416 %       \seq_get_left:cNF {g__stex_refs_labels_\l_tmpa_str_seq} \l_tmpa_str {
1417 %         \str_clear:N \l_tmpa_str
1418 %       }
1419 %     }{
1420 %       \str_clear:N \l_tmpa_str
1421 %     }
1422 %   }{
1423 %     \seq_pop_left:NN \l_tmpa_seq \l_tmpb_str
1424 %     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
1425 %     \int_set:Nn \l_tmpa_int { \exp_args:Ne \str_count:n {\l_tmpb_str?\l_tmpa_str} }
1426 %     \seq_if_exist:cTF{g__stex_refs_labels_\l_tmpa_str_seq}{
1427 %       \str_set_eq:NN \l_tmpc_str \l_tmpa_str
1428 %       \str_clear:N \l_tmpa_str
1429 %       \seq_map_inline:cn {g__stex_refs_labels_\l_tmpc_str_seq} {
1430 %         \str_if_eq:eeT { \l_tmpb_str?\l_tmpc_str }{
1431 %           \str_range:nnn { ##1 }{-\l_tmpa_int}{ -1 }
1432 %         }{
1433 %           \seq_map_break:n {
1434 %             \str_set:Nn \l_tmpa_str { ##1 }
1435 %           }
1436 %         }
1437 %       }
1438 %     }{
1439 %       \str_clear:N \l_tmpa_str
1440 %     }
1441 %   }
1442 % \str_if_empty:NTF \l_tmpa_str {
1443 %   \tl_if_empty:NTF \l__stex_refs_linktext_tl \l__stex_refs_fallback_tl \l__stex_refs_li
1444 % }{
1445 %   \str_if_eq:cNTF {sref_\l_tmpa_str_type} \c__stex_refs_ref_str {
1446 %     \tl_if_empty:NTF \l__stex_refs_linktext_tl {
1447 %       \cs_if_exist:cTF{autoref}{
1448 %         \l__stex_refs_pre_tl\exp_args:Nx\autoref{sref_\l_tmpa_str}\l__stex_refs_post_tl
1449 %       }{
1450 %         \l__stex_refs_pre_tl\exp_args:Nx\ref{sref_\l_tmpa_str}\l__stex_refs_post_tl
1451 %       }
1452 %     }{
1453 %       \ltx@ifpackageloaded{hyperref}{
1454 %         \hyperref[sref_\l_tmpa_str]\l__stex_refs_linktext_tl
1455 %       }{
1456 %         \l__stex_refs_linktext_tl
1457 %       }
1458 %     }
1459 %   }{

```

```

1460 % \ltx@ifpackageloaded{hyperref}{
1461 % \href{\use:c{sref_url_1\l_tmpa_str _str}}{\tl_if_empty:NTF \l__stex_refs_linktext_tl
1462 % }{
1463 % \tl_if_empty:NTF \l__stex_refs_linktext_tl \l__stex_refs_fallback_tl \l__stex_refs_fallback_tl
1464 % }
1465 % }
1466 % }
1467 % }{
1468 % TODO
1469 % }
1470 %}

```

(End definition for `\sref`. This function is documented on page 82.)

`\srefsym`

```

1471 \NewDocumentCommand \srefsym { 0{} m}{
1472 \stex_get_symbol:n { #2 }
1473 \__stex_refs_sym_aux:nn{#1}{\l_stex_get_symbol_uri_str}
1474 }
1475
1476 \cs_new_protected:Nn \__stex_refs_sym_aux:nn {
1477
1478 % \str_if_exist:cTF {sref_sym_#2 _label_str }{
1479 % \sref[#1]{\use:c{sref_sym_#2 _label_str}}
1480 % }{
1481 % \__stex_refs_args:n { #1 }
1482 % \str_if_empty:NTF \l__stex_refs_indocument_str {
1483 % \tl_if_exist:cTF{sref_sym_#2 _type}{
1484 % % doc uri in \l_tmpb_str
1485 % \str_set:Nx \l_tmpa_str {\use:c{sref_sym_#2 _type}}
1486 % \str_if_eq:NNTF \l_tmpa_str \c__stex_refs_ref_str {
1487 % % reference
1488 % \tl_if_empty:NTF \l__stex_refs_linktext_tl {
1489 % \cs_if_exist:cTF{autoref}{
1490 % \l__stex_refs_pre_tl\autoref{sref_sym_#2}\l__stex_refs_post_tl
1491 % }{
1492 % \l__stex_refs_pre_tl\ref{sref_sym_#2}\l__stex_refs_post_tl
1493 % }
1494 % }{
1495 % \ltx@ifpackageloaded{hyperref}{
1496 % \hyperref[sref_sym_#2]\l__stex_refs_linktext_tl
1497 % }{
1498 % \l__stex_refs_linktext_tl
1499 % }
1500 % }
1501 % }{
1502 % % URL
1503 % \ltx@ifpackageloaded{hyperref}{
1504 % \href{\use:c{sref_sym_url_#2 _str}}{\tl_if_empty:NTF \l__stex_refs_linktext_tl
1505 % }{
1506 % \tl_if_empty:NTF \l__stex_refs_linktext_tl \l__stex_refs_fallback_tl \l__stex_refs_fallback_tl
1507 % }
1508 % }
1509 % }{

```

```

1510 %          \tl_if_empty:NTF \l__stex_refs_linktext_tl \l__stex_refs_fallback_tl \l__stex_refs_
1511 %          }
1512 %      }{
1513 %          % TODO
1514 %      }
1515 %  }
1516 }

```

(End definition for `\srefsym`. This function is documented on page 82.)

`\srefsymuri`

```

1517 \cs_new_protected:Npn \srefsymuri #1 #2 { % TODO
1518   #2%\__stex_refs_sym_aux:nn{linktext={#2}}{#1}
1519 }

```

(End definition for `\srefsymuri`. This function is documented on page 82.)

```

1520 </package>

```

Chapter 29

STEX -Modules Implementation

```
1521 <*package>
1522
1523 %%%%%%%%%%% modules.dtx %%%%%%%%%%%
1524
1525 <@@=stex_modules>
1526
1527 Warnings and error messages
1528 \msg_new:nnn{stex}{error/unknownmodule}{
1529   No~module~#1~found
1530 }
1531 \msg_new:nnn{stex}{error/syntax}{
1532   Syntax~error:~#1
1533 }
1534 \msg_new:nnn{stex}{error/siglanguage}{
1535   Module~#1~declares~signature~#2,~but~does~not~
1536   declare~its~language
1537 }
1538 \msg_new:nnn{stex}{warning/deprecated}{
1539   #1~is~deprecated;~please~use~#2~instead!
1540 }
1541 \msg_new:nnn{stex}{error/conflictingmodules}{
1542   Conflicting~imports~for~module~#1
1543 }
```

\l_stex_current_module_str The current module:

```
1543 \str_new:N \l_stex_current_module_str
```

(End definition for \l_stex_current_module_str. This variable is documented on page 84.)

\l_stex_all_modules_seq Stores all available modules

```
1544 \seq_new:N \l_stex_all_modules_seq
```

(End definition for \l_stex_all_modules_seq. This variable is documented on page 84.)

```

\stex_if_in_module_p:
\stex_if_in_module:TF
1545 \prg_new_conditional:Nnn \stex_if_in_module: {p, T, F, TF} {
1546   \str_if_empty:NTF \l_stex_current_module_str
1547   \prg_return_false: \prg_return_true:
1548 }

(End definition for \stex_if_in_module:TF. This function is documented on page 84.)

```

```

\stex_if_module_exists_p:n
\stex_if_module_exists:nTF
1549 \prg_new_conditional:Nnn \stex_if_module_exists:n {p, T, F, TF} {
1550   \prop_if_exist:cTF { c_stex_module_#1_prop }
1551   \prg_return_true: \prg_return_false:
1552 }

(End definition for \stex_if_module_exists:nTF. This function is documented on page 84.)

```

```

\stex_add_to_current_module:n
\STEXexport
1553 \cs_new_protected:Nn \stex_execute_in_module:n { \stex_if_in_module:T {
1554   \stex_add_to_current_module:n { #1 }
1555   \stex_do_up_to_module:n { #1 }
1556 }}
1557 \cs_generate_variant:Nn \stex_execute_in_module:n {x}
1558
1559 \cs_new_protected:Nn \stex_add_to_current_module:n {
1560   \tl_gput_right:cn {c_stex_module_\l_stex_current_module_str_code} { #1 }
1561 }
1562 \cs_generate_variant:Nn \stex_add_to_current_module:n {x}
1563 \cs_new_protected:Npn \STEXexport {
1564   \ExplSyntaxOn
1565   \__stex_modules_export:n
1566 }
1567 \cs_new_protected:Nn \__stex_modules_export:n {
1568   \ignorespacesandpars#1\ExplSyntaxOff
1569   \stex_add_to_current_module:n { \ignorespacesandpars#1}
1570   \stex_smsmode_do:
1571 }
1572 \let \stex_module_export_helper:n \use:n
1573 \stex_deactivate_macro:Nn \STEXexport {module~environments}

(End definition for \stex_add_to_current_module:n and \STEXexport. These functions are documented
on page 84.)

```

```

\stex_add_constant_to_current_module:n
1574 \cs_new_protected:Nn \stex_add_constant_to_current_module:n {
1575   \str_set:Nx \l_tmpa_str { #1 }
1576   \seq_gput_right:co {c_stex_module_\l_stex_current_module_str_constants} { \l_tmpa_str }
1577 }

(End definition for \stex_add_constant_to_current_module:n. This function is documented on page
84.)

```

```

\stex_add_import_to_current_module:n
1578 \cs_new_protected:Nn \stex_add_import_to_current_module:n {
1579   \str_set:Nx \l_tmpa_str { #1 }
1580   \exp_args:Nno

```

```

1581 \seq_if_in:cnF{c_stex_module_\l_stex_current_module_str _imports}\l_tmpa_str{
1582 \seq_gput_right:co{c_stex_module_\l_stex_current_module_str _imports}\l_tmpa_str
1583 }
1584 }

```

(End definition for `\stex_add_import_to_current_module:n`. This function is documented on page 84.)

`\stex_collect_imports:n`

```

1585 \cs_new_protected:Nn \stex_collect_imports:n {
1586 \seq_clear:N \l_stex_collect_imports_seq
1587 \__stex_modules_collect_imports:n {#1}
1588 }
1589 \cs_new_protected:Nn \__stex_modules_collect_imports:n {
1590 \seq_map_inline:cn {c_stex_module_#1_imports} {
1591 \seq_if_in:NnF \l_stex_collect_imports_seq { ##1 } {
1592 \__stex_modules_collect_imports:n { ##1 }
1593 }
1594 }
1595 \seq_if_in:NnF \l_stex_collect_imports_seq { #1 } {
1596 \seq_put_right:Nx \l_stex_collect_imports_seq { #1 }
1597 }
1598 }

```

(End definition for `\stex_collect_imports:n`. This function is documented on page 84.)

`\stex_do_up_to_module:n`

```

1599 \int_new:N \l__stex_modules_group_depth_int
1600 \cs_new_protected:Nn \stex_do_up_to_module:n {
1601 \int_compare:nNnTF \l__stex_modules_group_depth_int = \currentgrouplevel {
1602 #1
1603 }{
1604 #1
1605 \expandafter \tl_gset:Nn
1606 \csname l__stex_modules_aftergroup_\l_stex_current_module_str _tl
1607 \expandafter\expandafter\expandafter\endcsname
1608 \expandafter\expandafter\expandafter { \csname
1609 l__stex_modules_aftergroup_\l_stex_current_module_str _tl\endcsname #1 }
1610 \aftergroup\__stex_modules_aftergroup_do:
1611 }
1612 }
1613 \cs_generate_variant:Nn \stex_do_up_to_module:n {x}
1614 \cs_new_protected:Nn \__stex_modules_aftergroup_do: {
1615 \stex_debug:nn{aftergroup}{\cs_meaning:c{
1616 l__stex_modules_aftergroup_\l_stex_current_module_str _tl
1617 }}
1618 \int_compare:nNnTF \l__stex_modules_group_depth_int = \currentgrouplevel {
1619 \use:c{l__stex_modules_aftergroup_\l_stex_current_module_str _tl}
1620 \tl_gclear:c{l__stex_modules_aftergroup_\l_stex_current_module_str _tl}
1621 }{
1622 \use:c{l__stex_modules_aftergroup_\l_stex_current_module_str _tl}
1623 \aftergroup\__stex_modules_aftergroup_do:
1624 }
1625 }
1626 \cs_new_protected:Nn \stex_reset_up_to_module:n {
1627 \expandafter\let\csname l__stex_modules_aftergroup_#1_tl\endcsname\undefined

```

1628 }

(End definition for `\stex_do_up_to_module:n`. This function is documented on page 84.)

`\stex_modules_compute_namespace:nN` Computes the appropriate namespace from the top-level namespace of a repository (#1) and a file path (#2).

1629

(End definition for `\stex_modules_compute_namespace:nN`. This function is documented on page ??.)

`\stex_modules_current_namespace:` Computes the current namespace based on the current MathHub repository (if existent) and the current file.

```
1630 \str_new:N \l_stex_module_ns_str
1631 \str_new:N \l_stex_module_subpath_str
1632 \cs_new_protected:Nn \__stex_modules_compute_namespace:nN {
1633   \seq_set_eq:NN \l_tmpa_seq #2
1634   % split off file extension
1635   \seq_pop_right:NN \l_tmpa_seq \l_tmpb_str % <- filename
1636   \exp_args:Nnno \seq_set_split:Nnn \l_tmpb_seq . \l_tmpb_str
1637   \seq_get_left:NN \l_tmpb_seq \l_tmpb_str % <- filename without suffixes
1638   \seq_put_right:No \l_tmpa_seq \l_tmpb_str % <- file path including name without suffixes
1639
1640   \bool_set_true:N \l_tmpa_bool
1641   \bool_while_do:Nn \l_tmpa_bool {
1642     \seq_pop_left:NN \l_tmpa_seq \l_tmpb_str
1643     \exp_args:No \str_case:nnTF { \l_tmpb_str } {
1644       {source} { \bool_set_false:N \l_tmpa_bool }
1645     }{}{
1646       \seq_if_empty:NT \l_tmpa_seq {
1647         \bool_set_false:N \l_tmpa_bool
1648       }
1649     }
1650   }
1651
1652   \stex_path_to_string:NN \l_tmpa_seq \l_stex_module_subpath_str
1653   % \l_tmpa_seq <- sub-path relative to archive
1654   \str_if_empty:NTF \l_stex_module_subpath_str {
1655     \str_set:Nx \l_stex_module_ns_str {#1}
1656   }{
1657     \str_set:Nx \l_stex_module_ns_str {
1658       #1/\l_stex_module_subpath_str
1659     }
1660   }
1661 }
1662
1663 \cs_new_protected:Nn \stex_modules_current_namespace: {
1664   \str_clear:N \l_stex_module_subpath_str
1665   \prop_if_exist:NTF \l_stex_current_repository_prop {
1666     \prop_get:NnN \l_stex_current_repository_prop { ns } \l_tmpa_str
1667     \__stex_modules_compute_namespace:nN \l_tmpa_str \g_stex_currentfile_seq
1668   }{
1669     % split off file extension
1670     \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
1671     \seq_pop_right:NN \l_tmpa_seq \l_tmpb_str
```

```

1672 \exp_args:NNno \seq_set_split:Nnn \l_tmpb_seq . \l_tmpb_str
1673 \seq_get_left:NN \l_tmpb_seq \l_tmpb_str
1674 \seq_put_right:No \l_tmpa_seq \l_tmpb_str
1675 \str_set:Nx \l_stex_module_ns_str {
1676   file:/\stex_path_to_string:N \l_tmpa_seq
1677 }
1678 }
1679 }

```

(End definition for `\stex_modules_current_namespace:.` This function is documented on page 85.)

29.1 The smodule environment

smodule arguments:

```

1680 \keys_define:nn { stex / module } {
1681   title      .tl_set:N      = \smodulename ,
1682   type       .str_set_x:N   = \smodulename ,
1683   id         .str_set_x:N   = \smoduleid ,
1684   deprecate  .str_set_x:N   = \l_stex_module_deprecate_str ,
1685   ns         .str_set_x:N   = \l_stex_module_ns_str ,
1686   lang       .str_set_x:N   = \l_stex_module_lang_str ,
1687   sig        .str_set_x:N   = \l_stex_module_sig_str ,
1688   creators   .str_set_x:N   = \l_stex_module_creators_str ,
1689   contributors .str_set_x:N = \l_stex_module_contributors_str ,
1690   meta       .str_set_x:N   = \l_stex_module_meta_str ,
1691   srccite    .str_set_x:N   = \l_stex_module_srccite_str
1692 }
1693
1694 \cs_new_protected:Nn \__stex_modules_args:n {
1695   \str_clear:N \smodulename
1696   \str_clear:N \smodulename
1697   \str_clear:N \smoduleid
1698   \str_clear:N \l_stex_module_ns_str
1699   \str_clear:N \l_stex_module_deprecate_str
1700   \str_clear:N \l_stex_module_lang_str
1701   \str_clear:N \l_stex_module_sig_str
1702   \str_clear:N \l_stex_module_creators_str
1703   \str_clear:N \l_stex_module_contributors_str
1704   \str_clear:N \l_stex_module_meta_str
1705   \str_clear:N \l_stex_module_srccite_str
1706   \keys_set:nn { stex / module } { #1 }
1707 }
1708
1709 % module parameters here? In the body?
1710

```

`\stex_module_setup:nn` Sets up a new module property list:

```

1711 \cs_new_protected:Nn \stex_module_setup:nn {
1712   \int_set:Nn \l__stex_modules_group_depth_int {\currentgrouplevel}
1713   \str_set:Nx \l_stex_module_name_str { #2 }
1714   \__stex_modules_args:n { #1 }

```


First, we set up the name and namespace of the module.

Are we in a nested module?

```

1715 \stex_if_in_module:TF {
1716   % Nested module
1717   \prop_get:cnN {c_stex_module_\l_stex_current_module_str _prop}
1718   { ns } \l_stex_module_ns_str
1719   \str_set:Nx \l_stex_module_name_str {
1720     \prop_item:cn {c_stex_module_\l_stex_current_module_str _prop}
1721     { name } / \l_stex_module_name_str
1722   }
1723   \str_if_empty:NT \l_stex_module_lang_str {
1724     \str_set:Nx \l_stex_module_lang_str {
1725       \prop_item:cn {c_stex_module_\l_stex_current_module_str _prop}
1726       { lang }
1727     }
1728   }
1729 }{
1730   % not nested:
1731   \str_if_empty:NT \l_stex_module_ns_str {
1732     \stex_modules_current_namespace:
1733     \exp_args:NNNo \seq_set_split:Nnn \l_tmpa_seq
1734     / {\l_stex_module_ns_str}
1735     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
1736     \str_if_eq:NNT \l_tmpa_str \l_stex_module_name_str {
1737       \str_set:Nx \l_stex_module_ns_str {
1738         \stex_path_to_string:N \l_tmpa_seq
1739       }
1740     }
1741   }
1742 }
```

Next, we determine the language of the module:

```

1743 \str_if_empty:NT \l_stex_module_lang_str {
1744   \seq_get_right:NN \g_stex_currentfile_seq \l_tmpa_str
1745   \seq_set_split:NnV \l_tmpa_seq . \l_tmpa_str
1746   \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str % .tex
1747   \exp_args:No \str_if_eq:nnF \l_tmpa_str {tex} {
1748     \exp_args:No \str_if_eq:nnF \l_tmpa_str {dtx} {
1749       \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq \l_tmpa_str
1750     }
1751   }
1752   \seq_pop_left:NN \l_tmpa_seq \l_tmpa_str % <filename>
1753   \seq_if_empty:NF \l_tmpa_seq { %remaining element should be [<something>.]language
1754     \seq_pop_right:NN \l_tmpa_seq \l_stex_module_lang_str
1755     \stex_debug:nn{modules} {Language~\l_stex_module_lang_str~
1756       inferred~from~file~name}
1757   }
1758 }
1759
1760 \stex_if_smsmode:F { \str_if_empty:NF \l_stex_module_lang_str {
1761   \exp_args:NNo \stex_set_language:Nn \l_tmpa_str \l_stex_module_lang_str
1762 }}
```

We check if we need to extend a signature module, and set `\l_stex_current_module_prop` accordingly:

```

1763 \str_if_empty:NTF \l_stex_module_sig_str {
1764   \exp_args:Nnx \prop_gset_from_keyval:cn {
1765     c_stex_module_\l_stex_module_ns_str?\l_stex_module_name_str _prop
1766   } {
1767     name      = \l_stex_module_name_str ,
1768     ns        = \l_stex_module_ns_str ,
1769     file      = \exp_not:o { \g_stex_currentfile_seq } ,
1770     lang      = \l_stex_module_lang_str ,
1771     sig       = \l_stex_module_sig_str ,
1772     deprecate = \l_stex_module_deprecate_str ,
1773     meta      = \l_stex_module_meta_str
1774   }
1775   \seq_clear:c {c_stex_module_\l_stex_module_ns_str?\l_stex_module_name_str _imports}
1776   \seq_clear:c {c_stex_module_\l_stex_module_ns_str?\l_stex_module_name_str _constants}
1777   \seq_clear:c {c_stex_module_\l_stex_module_ns_str?\l_stex_module_name_str _copymodules}
1778   \tl_clear:c {c_stex_module_\l_stex_module_ns_str?\l_stex_module_name_str _code}
1779   \str_set:Nx\l_stex_current_module_str{\l_stex_module_ns_str?\l_stex_module_name_str}

```

We load the metatheory:

```

1780 \str_if_empty:NT \l_stex_module_meta_str {
1781   \str_set_eq:NN \l_stex_module_meta_str \l_stex_metatheory_str
1782 }
1783 \str_if_eq:VnF \l_stex_module_meta_str {NONE} {
1784   \bool_set_true:N \l_stex_in_meta_bool
1785   \exp_args:Nx \stex_add_to_current_module:n {
1786     \bool_set_true:N \l_stex_in_meta_bool
1787     \stex_activate_module:n {\l_stex_module_meta_str}
1788     \bool_set_false:N \l_stex_in_meta_bool
1789   }
1790   \stex_activate_module:n {\l_stex_module_meta_str}
1791   \bool_set_false:N \l_stex_in_meta_bool
1792 }
1793 }{
1794   \str_if_empty:NT \l_stex_module_lang_str {
1795     \msg_error:nnxx{stex}{error/siglanguage}{
1796       \l_stex_module_ns_str?\l_stex_module_name_str
1797     }{\l_stex_module_sig_str}
1798   }
1799   \stex_debug:nn{modules}{Signature~\l_stex_module_sig_str~for~\l_stex_module_ns_str?\l_st
1800   \stex_if_module_exists:nTF{\l_stex_module_ns_str?\l_stex_module_name_str}{
1801     \stex_debug:nn{modules}{(already exists)}
1802   }{
1803     \stex_debug:nn{modules}{(needs loading)}
1804     \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
1805     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
1806     \seq_set_split:NnV \l_tmpb_seq . \l_tmpa_str
1807     \seq_pop_right:NN \l_tmpb_seq \l_tmpa_str % .tex
1808     \seq_pop_left:NN \l_tmpb_seq \l_tmpa_str % <filename>
1809     \str_set:Nx \l_tmpa_str {
1810       \stex_path_to_string:N \l_tmpa_seq /
1811       \l_tmpa_str . \l_stex_module_sig_str .tex
1812     }

```

```

1813 \IfFileExists \l_tmpa_str {
1814   \exp_args:No \stex_file_in_smsmode:nn { \l_tmpa_str } {
1815     \str_clear:N \l_stex_current_module_str
1816     \seq_clear:N \l_stex_all_modules_seq
1817     \stex_debug:nn{modules}{Loading~signature}
1818   }
1819   }{
1820     \msg_error:nnx{stex}{error/unknownmodule}{for~signature~\l_tmpa_str}
1821   }
1822 }
1823 \stex_if_smsmode:F {
1824   \stex_activate_module:n {
1825     \l_stex_module_ns_str ? \l_stex_module_name_str
1826   }
1827 }
1828 \str_set:Nx\l_stex_current_module_str{\l_stex_module_ns_str?\l_stex_module_name_str}
1829 }
1830 \str_if_empty:NF \l_stex_module_deprecate_str {
1831   \msg_warning:nnxx{stex}{warning/deprecated}{
1832     Module~\l_stex_current_module_str
1833   }{
1834     \l_stex_module_deprecate_str
1835   }
1836 }
1837 \seq_put_right:Nx \l_stex_all_modules_seq {
1838   \l_stex_module_ns_str ? \l_stex_module_name_str
1839 }
1840 \tl_clear:c{l_stex_modules_aftergroup \l_stex_module_ns_str ? \l_stex_module_name_str _tl}
1841 }

```

(End definition for `\stex_module_setup:nn`. This function is documented on page 85.)

`smodule (env.)` The module environment.

```

\__stex_modules_begin_module: implements \begin{smodule}
1842 \cs_new_protected:Nn \__stex_modules_begin_module: {
1843   \stex_reactivate_macro:N \STEXexport
1844   \stex_reactivate_macro:N \importmodule
1845   \stex_reactivate_macro:N \symdecl
1846   \stex_reactivate_macro:N \notation
1847   \stex_reactivate_macro:N \symdef
1848 }
1849 \stex_debug:nn{modules}{
1850   New~module:\\
1851   Namespace:~\l_stex_module_ns_str\\
1852   Name:~\l_stex_module_name_str\\
1853   Language:~\l_stex_module_lang_str\\
1854   Signature:~\l_stex_module_sig_str\\
1855   Metatheory:~\l_stex_module_meta_str\\
1856   File:~\stex_path_to_string:N \g_stex_currentfile_seq
1857 }
1858
1859 \stex_if_do_html:T{
1860   \begin{stex_annotate_env} {theory} {

```

```

1861 \l_stex_module_ns_str ? \l_stex_module_name_str
1862 }
1863
1864 \stex_annotate_invisible:nnn{header}{} {
1865 \stex_annotate:nnn{language}{ \l_stex_module_lang_str }{}
1866 \stex_annotate:nnn{signature}{ \l_stex_module_sig_str }{}
1867 \str_if_eq:VnF \l_stex_module_meta_str {NONE} {
1868 \stex_annotate:nnn{metatheory}{ \l_stex_module_meta_str }{}
1869 }
1870 \str_if_empty:NF \smoduletype {
1871 \stex_annotate:nnn{type}{\smoduletype}{}
1872 }
1873 }
1874 }
1875 % TODO: Inherit metatheory for nested modules?
1876 }
1877 \iffalse \end{stex_annotate_env} \fi %^^A make syntax highlighting work again

```

(End definition for _stex_modules_begin_module:.)

_stex_modules_end_module: implements \end{module}

```

1878 \cs_new_protected:Nn \_stex_modules_end_module: {
1879 \stex_debug:nn{modules}{Closing~module~\prop_item:cn {c_stex_module_\l_stex_current_module}
1880 \_stex_reset_up_to_module:n \l_stex_current_module_str
1881 \stex_if_smsmode:T {
1882 \stex_persist:x {
1883 \prop_set_from_keyval:cn{c_stex_module_\l_stex_current_module_str _prop}{
1884 \exp_after:wN \prop_to_keyval:N \csname c_stex_module_\l_stex_current_module_str _pr
1885 }
1886 \seq_set_from_clist:cn{c_stex_module_\l_stex_current_module_str _constants}{
1887 \seq_use:cn{c_stex_module_\l_stex_current_module_str _constants},
1888 }
1889 \seq_set_from_clist:cn{c_stex_module_\l_stex_current_module_str _imports}{
1890 \seq_use:cn{c_stex_module_\l_stex_current_module_str _imports},
1891 }
1892 \tl_set:cn {c_stex_module_\l_stex_current_module_str _code}
1893 }
1894 \exp_after:wN \let \exp_after:wN \l_tmpa_tl \csname c_stex_module_\l_stex_current_module
1895 \exp_after:wN \stex_persist:n \exp_after:wN { \exp_after:wN { \l_tmpa_tl } }
1896 }
1897 }

```

(End definition for _stex_modules_end_module:.)

The core environment

```

1898 \iffalse \begin{stex_annotate_env} \fi %^^A make syntax highlighting work again
1899 \NewDocumentEnvironment { smodule } { 0{} m } {
1900 \stex_module_setup:nn{#1}{#2}
1901 %\par
1902 \stex_if_smsmode:F{
1903 \tl_if_empty:NF \smoduletitle {
1904 \exp_args:No \stex_document_title:n \smoduletitle
1905 }
1906 \tl_clear:N \l_tmpa_tl
1907 \clist_map_inline:Nn \smoduletype {

```

```

1908     \tl_if_exist:cT {__stex_modules_smodule_##1_start:}{
1909         \tl_set:Nn \l_tmpa_tl {
1910             \stex_patch_counters:
1911             \use:c{__stex_modules_smodule_##1_start:}
1912             \stex_unpatch_counters:
1913         }
1914     }
1915 }
1916 \tl_if_empty:NTF \l_tmpa_tl {
1917     \__stex_modules_smodule_start:
1918 }{
1919     \l_tmpa_tl
1920 }
1921 }
1922 \__stex_modules_begin_module:
1923 \str_if_empty:NF \smoduleid {
1924     \stex_ref_new_doc_target:n \smoduleid
1925 }
1926 \stex_smsmode_do:
1927 } {
1928     \__stex_modules_end_module:
1929     \stex_if_smsmode:F {
1930         \end{stex_annotate_env}
1931         \clist_set:Nn \l_tmpa_clist \smoduletype
1932         \tl_clear:N \l_tmpa_tl
1933         \clist_map_inline:Nn \l_tmpa_clist {
1934             \tl_if_exist:cT {__stex_modules_smodule_##1_end:}{
1935                 \tl_set:Nn \l_tmpa_tl {\use:c{__stex_modules_smodule_##1_end:}}
1936             }
1937         }
1938         \tl_if_empty:NTF \l_tmpa_tl {
1939             \__stex_modules_smodule_end:
1940         }{
1941             \l_tmpa_tl
1942         }
1943     }
1944 }

```

\stexpatchmodule

```

1945 \cs_new_protected:Nn \__stex_modules_smodule_start: {}
1946 \cs_new_protected:Nn \__stex_modules_smodule_end: {}
1947
1948 \newcommand\stexpatchmodule[3] [] {
1949     \str_set:Nx \l_tmpa_str{ #1 }
1950     \str_if_empty:NTF \l_tmpa_str {
1951         \tl_set:Nn \__stex_modules_smodule_start: { #2 }
1952         \tl_set:Nn \__stex_modules_smodule_end: { #3 }
1953     }{
1954         \exp_after:wN \tl_set:Nn \csname __stex_modules_smodule_#1_start:\endcsname{ #2 }
1955         \exp_after:wN \tl_set:Nn \csname __stex_modules_smodule_#1_end:\endcsname{ #3 }
1956     }
1957 }

```

(End definition for \stexpatchmodule. This function is documented on page 85.)

29.2 Invoking modules

```

\STEXModule
\stex_invoke_module:n
1958 \NewDocumentCommand \STEXModule { m } {
1959   \exp_args:NNx \str_set:Nn \l_tmpa_str { #1 }
1960   \int_set:Nn \l_tmpa_int { \str_count:N \l_tmpa_str }
1961   \tl_set:Nn \l_tmpa_tl {
1962     \msg_error:nnx{stex}{error/unknownmodule}{#1}
1963   }
1964   \seq_map_inline:Nn \l_stex_all_modules_seq {
1965     \str_set:Nn \l_tmpb_str { ##1 }
1966     \str_if_eq:eeT { \l_tmpa_str } {
1967       \str_range:Nnn \l_tmpb_str { -\l_tmpa_int } { -1 }
1968     } {
1969       \seq_map_break:n {
1970         \tl_set:Nn \l_tmpa_tl {
1971           \stex_invoke_module:n { ##1 }
1972         }
1973       }
1974     }
1975   }
1976   \l_tmpa_tl
1977 }
1978
1979 \cs_new_protected:Nn \stex_invoke_module:n {
1980   \stex_debug:nn{modules}{Invoking~module~#1}
1981   \peek_charcode_remove:NTF ! {
1982     \__stex_modules_invoke_uri:nN { #1 }
1983   } {
1984     \peek_charcode_remove:NTF ? {
1985       \__stex_modules_invoke_symbol:nn { #1 }
1986     } {
1987       \msg_error:nnx{stex}{error/syntax}{
1988         ?~or~!~expected~after~
1989         \c_backslash_str STEXModule{#1}
1990       }
1991     }
1992   }
1993 }
1994
1995 \cs_new_protected:Nn \__stex_modules_invoke_uri:nN {
1996   \str_set:Nn #2 { #1 }
1997 }
1998
1999 \cs_new_protected:Nn \__stex_modules_invoke_symbol:nn {
2000   \stex_invoke_symbol:n{#1?#2}
2001 }

```

(End definition for `\STEXModule` and `\stex_invoke_module:n`. These functions are documented on page 85.)

```

\stex_activate_module:n
2002 \bool_new:N \l_stex_in_meta_bool
2003 \bool_set_false:N \l_stex_in_meta_bool

```

```

2004 \cs_new_protected:Nn \stex_activate_module:n {
2005   \exp_args:NNx \seq_if_in:NnF \l_stex_all_modules_seq { #1 } {
2006     \stex_debug:nn{modules}{Activating~module~#1}
2007     \seq_put_right:Nx \l_stex_all_modules_seq { #1 }
2008     \use:c{ c_stex_module_#1_code }
2009   }
2010 }

```

(End definition for `\stex_activate_module:n`. This function is documented on page 86.)

`mmtinterface (env.)`

```

2011 \NewDocumentEnvironment { mmtinterface } { 0{} m m } {
2012   \stex_module_setup:nn{#1}{#3}
2013   %\par
2014   \stex_if_smsmode:F{
2015     \tl_if_empty:NF \smoduletitle {
2016       \exp_args:No \stex_document_title:n \smoduletitle
2017     }
2018     \tl_clear:N \l_tmpa_tl
2019     \clist_map_inline:Nn \smoduletype {
2020       \tl_if_exist:cT {__stex_modules_smodule_##1_start:}{
2021         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_modules_smodule_##1_start:}}
2022       }
2023     }
2024     \tl_if_empty:NTF \l_tmpa_tl {
2025       \__stex_modules_smodule_start:
2026     }{
2027       \l_tmpa_tl
2028     }
2029   }
2030   \__stex_modules_begin_module:
2031   \str_if_empty:NF \smoduleid {
2032     \stex_ref_new_doc_target:n \smoduleid
2033   }
2034   \str_set:Nx \l_stex_module_mmtfor_str {#2}
2035   \MMTinclude{#2}
2036   \stex_reactivate_macro:N \mmtdecl
2037   \stex_reactivate_macro:N \mmtdef
2038   \stex_smsmode_do:
2039 }{
2040   \__stex_modules_end_module:
2041   \stex_if_smsmode:F {
2042     \end{stex_annotate_env}
2043     \clist_set:No \l_tmpa_clist \smoduletype
2044     \tl_clear:N \l_tmpa_tl
2045     \clist_map_inline:Nn \l_tmpa_clist {
2046       \tl_if_exist:cT {__stex_modules_smodule_##1_end:}{
2047         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_modules_smodule_##1_end:}}
2048       }
2049     }
2050     \tl_if_empty:NTF \l_tmpa_tl {
2051       \__stex_modules_smodule_end:
2052     }{
2053       \l_tmpa_tl

```

```
2054     }  
2055   }  
2056 }  
2057 </package>
```


Chapter 30

STEX -Module Inheritance Implementation

```
2058 <*package>
2059
2060 %%%%%%%%%% inheritance.dtx %%%%%%%%%%
2061
```

30.1 SMS Mode

```
2062 <@@=stex_smsmode>

\g_stex_smsmode_allowedmacros_tl
\g_stex_smsmode_allowedmacros_escape_tl
\g_stex_smsmode_allowedenvs_seq

2063 \tl_new:N \g_stex_smsmode_allowedmacros_tl
2064 \tl_new:N \g_stex_smsmode_allowedmacros_escape_tl
2065 \seq_new:N \g_stex_smsmode_allowedenvs_seq
2066
2067 \tl_set:Nn \g_stex_smsmode_allowedmacros_tl {
2068   \makeatletter
2069   \makeatother
2070   \ExplSyntaxOn
2071   \ExplSyntaxOff
2072   \rustexBREAK
2073 }
2074
2075 \tl_set:Nn \g_stex_smsmode_allowedmacros_escape_tl {
2076   \symdef
2077   \importmodule
2078   \notation
2079   \symdecl
2080   \STEXexport
2081   \inlineass
2082   \inlinedef
2083   \inlineex
2084   \endinput
2085   \setnotation
```

```

2086 \copynotation
2087 \assign
2088 \renamedekl
2089 \donotcopy
2090 \instantiate
2091 \textsymdecl
2092 \mmtdef
2093 \setmetatheory
2094 }
2095
2096 \exp_args:Nx \seq_set_from_clist:Nn \g_stex_smsmode_allowedenvs_seq {
2097   \tl_to_str:n {
2098     smodule,
2099     copymodule,
2100     interpretmodule,
2101     realization,
2102     sdefinition,
2103     sexample,
2104     sassertion,
2105     sparagraph,
2106     mmtinterface,
2107     mathstructure,
2108     extstructure,
2109     extstructure*
2110   }
2111 }

```

(End definition for `\g_stex_smsmode_allowedmacros_tl`, `\g_stex_smsmode_allowedmacros_escape_tl`, and `\g_stex_smsmode_allowedenvs_seq`. These variables are documented on page 87.)

`\stex_if_smsmode_p:`

```

\stex_if_smsmode:TF
2112 \bool_new:N \g__stex_smsmode_bool
2113 \bool_set_false:N \g__stex_smsmode_bool
2114 \prg_new_conditional:Nnn \stex_if_smsmode: { p, T, F, TF } {
2115   \bool_if:NTF \g__stex_smsmode_bool \prg_return_true: \prg_return_false:
2116 }

```

(End definition for `\stex_if_smsmode:TF`. This function is documented on page 87.)

`_stex_smsmode_in_smsmode:nn`

```

2117 \cs_new_protected:Nn \_stex_smsmode_in_smsmode:nn { \stex_suppress_html:n {
2118   \vbox_set:Nn \l_tmpa_box {
2119     \bool_set_eq:cN { l__stex_smsmode_#1_bool } \g__stex_smsmode_bool
2120     \bool_gset_true:N \g__stex_smsmode_bool
2121     #2
2122     \bool_gset_eq:Nc \g__stex_smsmode_bool { l__stex_smsmode_#1_bool }
2123   }
2124   \box_clear:N \l_tmpa_box
2125 } }

```

(End definition for `_stex_smsmode_in_smsmode:nn`.)

`\stex_file_in_smsmode:nn`

```

2126 \quark_new:N \q__stex_smsmode_break
2127

```

```

2128 \NewDocumentCommand \__stex_smsmode_importmodule: { 0{} m} {
2129   \seq_gput_right:Nn \l__stex_smsmode_importmodules_seq {{#1}{#2}}
2130   \stex_smsmode_do:
2131 }
2132
2133 \cs_new_protected:Nn \__stex_smsmode_module:nn {
2134   \__stex_modules_args:n{#1}
2135   \stex_if_in_module:F {
2136     \str_if_empty:NF \l_stex_module_sig_str {
2137       \stex_modules_current_namespace:
2138       \str_set:Nx \l_stex_module_name_str { #2 }
2139       \stex_if_module_exists:nF{\l_stex_module_ns_str?\l_stex_module_name_str}{
2140         \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
2141         \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
2142         \seq_set_split:NnV \l_tmpb_seq . \l_tmpa_str
2143         \seq_pop_right:NN \l_tmpb_seq \l_tmpa_str % .tex
2144         \seq_pop_left:NN \l_tmpb_seq \l_tmpa_str % <filename>
2145         \str_set:Nx \l_tmpa_str {
2146           \stex_path_to_string:N \l_tmpa_seq /
2147           \l_tmpa_str . \l_stex_module_sig_str .tex
2148         }
2149         \IfFileExists \l_tmpa_str {
2150           \exp_args:NNx \seq_gput_right:Nn \l__stex_smsmode_sigmodules_seq \l_tmpa_str
2151         }{
2152           \msg_error:nnx{stex}{error/unknownmodule}{for~signature~\l_tmpa_str}
2153         }
2154       }
2155     }
2156   }
2157 }
2158
2159 \prg_new_conditional:Nnn \__stex_smsmode_check_import_pair:nn {T,F,TF} {
2160   %\stex_debug:nn{import-pair}{\detokenize{{#1}~{#2}}}}
2161   \tl_if_empty:nTF{#1}{
2162     \prop_if_exist:NTF \l_stex_current_repository_prop
2163     {
2164       %\stex_debug:nn{import-pair}{in repository \prop_item:Nn \l_stex_current_repository_
2165       \prg_return_true:
2166     } {
2167       \seq_set_split:Nnn \l_tmpa_seq ? {#2}
2168       \seq_get_left:NN \l_tmpa_seq \l_tmpa_tl
2169       \tl_if_empty:NT \l_tmpa_tl {
2170         \seq_pop_left:NN \l_tmpa_seq \l_tmpa_tl
2171       }
2172       %\stex_debug:nn{import-pair}{\seq_use:Nn \l_tmpa_seq,~of~length~\seq_count:N \l_tmpa_
2173       \int_compare:nNnTF {\seq_count:N \l_tmpa_seq} > 1
2174       \prg_return_true: \prg_return_false:
2175     }
2176   }\prg_return_true:
2177 }
2178
2179 \cs_new_protected:Nn \stex_file_in_smsmode:nn {
2180   \stex_filestack_push:n{#1}
2181   \seq_gclear:N \l__stex_smsmode_importmodules_seq

```

```

2182 \seq_gclear:N \l__stex_smsmode_sigmodules_seq
2183 % ----- new -----
2184 \__stex_smsmode_in_smsmode:nn{#1}{
2185   \let\importmodule\__stex_smsmode_importmodule:
2186   \let\stex_module_setup:nn\__stex_smsmode_module:nn
2187   \let\__stex_modules_begin_module:\relax
2188   \let\__stex_modules_end_module:\relax
2189   \seq_clear:N \g_stex_smsmode_allowedenvs_seq
2190   \exp_args:NNx \seq_put_right:Nn \g_stex_smsmode_allowedenvs_seq {\tl_to_str:n{smodule}}
2191   \tl_clear:N \g_stex_smsmode_allowedmacros_tl
2192   \tl_clear:N \g_stex_smsmode_allowedmacros_escape_tl
2193   \tl_put_right:Nn \g_stex_smsmode_allowedmacros_escape_tl {\importmodule}
2194   \everyeof{\q__stex_smsmode_break\noexpand}
2195   \expandafter\expandafter\expandafter
2196   \stex_smsmode_do:
2197   \csname @ @ input\endcsname "#1"\relax
2198
2199   \seq_map_inline:Nn \l__stex_smsmode_sigmodules_seq {
2200     \stex_filestack_push:n{##1}
2201     \expandafter\expandafter\expandafter
2202     \stex_smsmode_do:
2203     \csname @ @ input\endcsname "##1"\relax
2204     \stex_filestack_pop:
2205   }
2206 }
2207 % ----- new -----
2208 \__stex_smsmode_in_smsmode:nn{#1} {
2209   #2
2210   % ----- new -----
2211   \begingroup
2212   %\stex_debug:nn{smsmode}{Here:~\seq_use:Nn\l__stex_smsmode_importmodules_seq, }
2213   \seq_map_inline:Nn \l__stex_smsmode_importmodules_seq {
2214     \__stex_smsmode_check_import_pair:nnT ##1 { \begingroup
2215       \stex_import_module_uri:nn ##1
2216       \stex_import_require_module:nnnn
2217       \l_stex_import_ns_str
2218       \l_stex_import_archive_str
2219       \l_stex_import_path_str
2220       \l_stex_import_name_str \endgroup
2221     }
2222   }
2223   \endgroup
2224   \stex_debug:nn{smsmode}{Actually~loading~file~#1}
2225   % ----- new -----
2226   \everyeof{\q__stex_smsmode_break\noexpand}
2227   \expandafter\expandafter\expandafter
2228   \stex_smsmode_do:
2229   \csname @ @ input\endcsname "#1"\relax
2230 }
2231 \stex_filestack_pop:
2232 }

```

(End definition for `\stex_file_in_smsmode:nn`. This function is documented on page 88.)

`\stex_smsmode_do:` is executed on encountering `\` in smsmode. It checks whether the corresponding command

is allowed and executes or ignores it accordingly:

```

2233 \cs_new_protected:Npn \stex_smsmode_do: {
2234   \stex_if_smsmode:T {
2235     \__stex_smsmode_do:w
2236   }
2237 }
2238 \cs_new_protected:Npn \__stex_smsmode_do:w #1 {
2239   \exp_args:Nx \tl_if_empty:nTF { \tl_tail:n{ #1 } }{
2240     \expandafter\if\expandafter\relax\noexpand#1
2241     \expandafter\__stex_smsmode_do_aux:N\expandafter#1
2242   } \else\expandafter\__stex_smsmode_do:w\fi
2243 }{
2244   \__stex_smsmode_do:w % #1
2245 }
2246 }
2247 \cs_new_protected:Nn \__stex_smsmode_do_aux:N {
2248   \cs_if_eq:NNF #1 \q__stex_smsmode_break {
2249     \tl_if_in:NnTF \g_stex_smsmode_allowedmacros_tl {#1} {
2250       #1\__stex_smsmode_do:w
2251     }{
2252       \tl_if_in:NnTF \g_stex_smsmode_allowedmacros_escape_tl {#1} {
2253         #1
2254       }{
2255         \cs_if_eq:NNTF \begin #1 {
2256           \__stex_smsmode_check_begin:n
2257         }{
2258           \cs_if_eq:NNTF \end #1 {
2259             \__stex_smsmode_check_end:n
2260           }{
2261             \__stex_smsmode_do:w
2262           }
2263         }
2264       }
2265     }
2266   }
2267 }
2268 }
2269 \cs_new_protected:Nn \__stex_smsmode_check_begin:n {
2270   \seq_if_in:NxTF \g_stex_smsmode_allowedenvs_seq { \detokenize{#1} }{
2271     \begin{#1}
2272   }{
2273     \__stex_smsmode_do:w
2274   }
2275 }
2276 \cs_new_protected:Nn \__stex_smsmode_check_end:n {
2277   \seq_if_in:NxTF \g_stex_smsmode_allowedenvs_seq { \detokenize{#1} }{
2278     \end{#1}\__stex_smsmode_do:w
2279   }{
2280     \str_if_eq:nnTF{#1}{document}{\endinput}{\__stex_smsmode_do:w}
2281   }
2282 }

```

(End definition for `\stex_smsmode_do:`. This function is documented on page 88.)

30.2 Inheritance

2283 <@@=stex_importmodule>

\stex_import_module_uri:nn

```

2284 \cs_new_protected:Nn \stex_import_module_uri:nn {
2285   \str_set:Nx \l_stex_import_archive_str { #1 }
2286   \str_set:Nn \l_stex_import_path_str { #2 }
2287
2288   \exp_args:NNNo \seq_set_split:Nnn \l_tmpb_seq ? { \l_stex_import_path_str }
2289   \seq_pop_right:NN \l_tmpb_seq \l_stex_import_name_str
2290   \str_set:Nx \l_stex_import_path_str { \seq_use:Nn \l_tmpb_seq ? }
2291
2292   \stex_modules_current_namespace:
2293   \bool_lazy_all:nTF {
2294     {\str_if_empty_p:N \l_stex_import_archive_str}
2295     {\str_if_empty_p:N \l_stex_import_path_str}
2296     {\stex_if_module_exists_p:n { \l_stex_module_ns_str ? \l_stex_import_name_str } }
2297   }{
2298     \str_set_eq:NN \l_stex_import_path_str \l_stex_module_subpath_str
2299     \str_set_eq:NN \l_stex_import_ns_str \l_stex_module_ns_str
2300   }{
2301     \str_if_empty:NT \l_stex_import_archive_str {
2302       \prop_if_exist:NT \l_stex_current_repository_prop {
2303         \prop_get:NnN \l_stex_current_repository_prop { id } \l_stex_import_archive_str
2304       }
2305     }
2306     \str_if_empty:NTF \l_stex_import_archive_str {
2307       \str_if_empty:NF \l_stex_import_path_str {
2308         \stex_path_from_string:Nn \l_tmpb_seq {
2309           \l_stex_module_ns_str / .. / \l_stex_import_path_str
2310         }
2311         \str_set:Nx \l_stex_import_ns_str {\stex_path_to_string:N \l_tmpb_seq}
2312         \str_replace_once:Nnn \l_stex_import_ns_str {file://} {file://}
2313       }
2314     }{
2315       \stex_require_repository:n \l_stex_import_archive_str
2316       \prop_get:cnN { c_stex_mathhub_\l_stex_import_archive_str _manifest_prop } { ns }
2317       \l_stex_import_ns_str
2318       \str_if_empty:NF \l_stex_import_path_str {
2319         \str_set:Nx \l_stex_import_ns_str {
2320           \l_stex_import_ns_str / \l_stex_import_path_str
2321         }
2322       }
2323     }
2324   }
2325 }
```

(End definition for \stex_import_module_uri:nn. This function is documented on page 89.)

\l_stex_import_name_str
\l_stex_import_archive_str
\l_stex_import_path_str
\l_stex_import_ns_str

Store the return values of \stex_import_module_uri:nn.

```

2326 \str_new:N \l_stex_import_name_str
2327 \str_new:N \l_stex_import_archive_str
2328 \str_new:N \l_stex_import_path_str
2329 \str_new:N \l_stex_import_ns_str
```

(End definition for `\l_stex_import_name_str` and others. These variables are documented on page 89.)

```

\stex_import_require_module:nnnn {\langle ns \rangle} {\langle archive-ID \rangle} {\langle path \rangle} {\langle name \rangle}

2330 \cs_new_protected:Nn \stex_import_require_module:nnnn {
2331   \exp_args:Nx \stex_if_module_exists:nF { #1 ? #4 } {
2332
2333     \stex_debug:nn{requiremodule}{Here:\!\!\sim1:\sim1\!\!\sim2:\sim2\!\!\sim3:\sim3\!\!\sim4:\sim4}
2334
2335     \exp_args:NNxx \seq_set_split:Nnn \l_tmpa_seq {\tl_to_str:n{/}} {#4}
2336     \seq_get_left:NN \l_tmpa_seq \l_tmpc_str
2337
2338     %\stex_debug:nn{requiremodule}{Top-module:\l_tmpc_str}
2339
2340     % archive
2341     \str_set:Nx \l_tmpa_str { #2 }
2342     \str_if_empty:NTF \l_tmpa_str {
2343       \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
2344       \seq_put_right:Nn \l_tmpa_seq {...}
2345     } {
2346       \stex_path_from_string:Nn \l_tmpb_seq { \l_tmpa_str }
2347       \seq_concat:NNN \l_tmpa_seq \c_stex_mathhub_seq \l_tmpb_seq
2348       \seq_put_right:Nn \l_tmpa_seq { source }
2349     }
2350
2351     % path
2352     \str_set:Nx \l_tmpb_str { #3 }
2353     \str_if_empty:NTF \l_tmpb_str {
2354       \str_set:Nx \l_tmpa_str { \stex_path_to_string:N \l_tmpa_seq / \l_tmpc_str }
2355
2356       \ltx@ifpackageloaded{babel} {
2357         \exp_args:NNx \prop_get:NnNF \c_stex_language_abbrevs_prop
2358           { \language_name } \l_tmpb_str {
2359           \msg_error:nnx{stex}{error/unknownlanguage}{\language_name}
2360         }
2361       } {
2362         \str_clear:N \l_tmpb_str
2363       }
2364
2365       \stex_debug:nn{modules}{Checking-a1~\l_tmpa_str.\l_tmpb_str.tex}
2366       \IfFileExists{ \l_tmpa_str.\l_tmpb_str.tex }{
2367         \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.\l_tmpb_str.tex }
2368       }{
2369         \stex_debug:nn{modules}{Checking-a2~\l_tmpa_str.tex}
2370         \IfFileExists{ \l_tmpa_str.tex }{
2371           \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.tex }
2372         }{
2373           % try english as default
2374           \stex_debug:nn{modules}{Checking-a3~\l_tmpa_str.en.tex}
2375           \IfFileExists{ \l_tmpa_str.en.tex }{
2376             \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.en.tex }
2377           }{
2378             \msg_error:nnx{stex}{error/unknownmodule}{#1?#4}
2379           }
2380         }

```

```

2381     }
2382
2383   } {
2384     \seq_set_split:NnV \l_tmpb_seq / \l_tmpb_str
2385     \seq_concat:NNN \l_tmpb_seq \l_tmpa_seq \l_tmpb_seq
2386
2387     \ltx@ifpackageloaded{babel} {
2388       \exp_args:Nn \prop_get:NnNF \c_stex_language_abbrevs_prop
2389         { \language } \l_tmpb_str {
2390         \msg_error:nnx{stex}{error/unknownlanguage}{\language}
2391       }
2392     } {
2393       \str_clear:N \l_tmpb_str
2394     }
2395
2396     \stex_path_canonicalize:N \l_tmpb_seq
2397     \stex_path_to_string:NN \l_tmpb_seq \l_tmpa_str
2398
2399     \stex_debug:nn{modules}{Checking~b1~\l_tmpa_str/\l_tmpc_str.\l_tmpb_str.tex}
2400     \IfFileExists{ \l_tmpa_str/\l_tmpc_str.\l_tmpb_str.tex }{
2401       \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str/\l_tmpc_str.\l_tmpb_str.tex }
2402     }{
2403       \stex_debug:nn{modules}{Checking~b2~\l_tmpa_str/\l_tmpc_str.tex}
2404       \IfFileExists{ \l_tmpa_str/\l_tmpc_str.tex }{
2405         \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str/\l_tmpc_str.tex }
2406       }{
2407         % try english as default
2408         \stex_debug:nn{modules}{Checking~b3~\l_tmpa_str/\l_tmpc_str.en.tex}
2409         \IfFileExists{ \l_tmpa_str/\l_tmpc_str.en.tex }{
2410           \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str/\l_tmpc_str.en.tex }
2411         }{
2412           \stex_debug:nn{modules}{Checking~b4~\l_tmpa_str.\l_tmpb_str.tex}
2413           \IfFileExists{ \l_tmpa_str.\l_tmpb_str.tex }{
2414             \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.\l_tmpb_str.tex }
2415           }{
2416             \stex_debug:nn{modules}{Checking~b4~\l_tmpa_str.tex}
2417             \IfFileExists{ \l_tmpa_str.tex }{
2418               \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.tex }
2419             }{
2420               % try english as default
2421               \stex_debug:nn{modules}{Checking~b5~\l_tmpa_str.en.tex}
2422               \IfFileExists{ \l_tmpa_str.en.tex }{
2423                 \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.en.tex }
2424               }{
2425                 \msg_error:nnx{stex}{error/unknownmodule}{#1?#4}
2426               }
2427             }
2428           }
2429         }
2430       }
2431     }
2432   }
2433
2434   \str_if_eq:eeF{\g__stex_importmodule_file_str}{\seq_use:Nn \g_stex_currentfile_seq /}{

```



```

2435 \exp_args:No \stex_file_in_smsmode:nn { \g__stex_importmodule_file_str } {
2436 \seq_clear:N \l_stex_all_modules_seq
2437 \str_clear:N \l_stex_current_module_str
2438 \str_set:Nx \l_tmpb_str { #2 }
2439 \str_if_empty:NF \l_tmpb_str {
2440 \stex_set_current_repository:n { #2 }
2441 }
2442 \stex_debug:nn{modules}{Loading~\g__stex_importmodule_file_str}
2443 }
2444
2445 \stex_if_module_exists:nF { #1 ? #4 } {
2446 \msg_error:nnx{stex}{error/unknownmodule}{
2447 #1?#4~(in~file~\g__stex_importmodule_file_str)
2448 }
2449 }
2450 }
2451
2452 }
2453 \stex_activate_module:n { #1 ? #4 }
2454 }

```

(End definition for `\stex_import_require_module:nnnn`. This function is documented on page 89.)

`\importmodule`

```

2455 \NewDocumentCommand \importmodule { 0{} m } {
2456 \stex_import_module_uri:nn { #1 } { #2 }
2457 \stex_debug:nn{modules}{Importing~module:~
2458 \l_stex_import_ns_str ? \l_stex_import_name_str
2459 }
2460 \stex_if_smsmode:F {
2461 \stex_annotate_invisible:nnn
2462 {import} {\l_stex_import_ns_str ? \l_stex_import_name_str} {}
2463 }
2464 \stex_execute_in_module:x {
2465 \stex_import_require_module:nnnn
2466 { \l_stex_import_ns_str } { \l_stex_import_archive_str }
2467 { \l_stex_import_path_str } { \l_stex_import_name_str }
2468 }
2469 \exp_args:Nx \stex_add_import_to_current_module:n {
2470 \l_stex_import_ns_str ? \l_stex_import_name_str
2471 }
2472 \stex_smsmode_do:
2473 \ignorespacesandpars
2474 }
2475 \stex_deactivate_macro:Nn \importmodule {module~environments}

```

(End definition for `\importmodule`. This function is documented on page 88.)

`\usemodule`

```

2476 \NewDocumentCommand \usemodule { 0{} m } {
2477 \stex_if_smsmode:F {
2478 \stex_import_module_uri:nn { #1 } { #2 }
2479 \stex_import_require_module:nnnn
2480 { \l_stex_import_ns_str } { \l_stex_import_archive_str }
2481 { \l_stex_import_path_str } { \l_stex_import_name_str }

```

```

2482 \stex_annotate_invisible:nnn
2483 {usemodule} {\l_stex_import_ns_str ? \l_stex_import_name_str} {}
2484 }
2485 \stex_smsmode_do:
2486 \ignorespacesandpars
2487 }

```

(End definition for \usemodule. This function is documented on page 88.)

```

2488 \cs_new_protected:Nn \stex_csl_to_imports:Nn {
2489 \tl_if_empty:nF{#2}{
2490 \clist_set:Nn \l_tmpa_clist {#2}
2491 \clist_map_inline:Nn \l_tmpa_clist {
2492 \tl_if_head_eq_charcode:nNTF {##1}[{
2493 #1 ##1
2494 }{
2495 #1{##1}
2496 }
2497 }
2498 }
2499 }
2500 \cs_generate_variant:Nn \stex_csl_to_imports:Nn {No}
2501
2502
2503 \</package>

```

Chapter 31

STEX -Symbols Implementation

```
2504 <*package>
2505
2506 %%%%%%%%%% symbols.dtx %%%%%%%%%%
2507
2508 Warnings and error messages
2509 \msg_new:nnn{stex}{error/wrongargs}{
2510   args~value~in~symbol~declaration~for~#1~
2511   needs~to~be~i,~a,~b~or~B,~but~#2~given
2512 }
2513 \msg_new:nnn{stex}{error/unknownsymbol}{
2514   No~symbol~#1~found!
2515 }
2516 \msg_new:nnn{stex}{error/seqlength}{
2517   Expected~#1~arguments;~got~#2!
2518 }
2519 \msg_new:nnn{stex}{error/unknownnotation}{
2520   Unknown~notation~#1~for~#2!
2521 }
```

31.1 Symbol Declarations

```
2521 <@@=stex_symdecl>
\stex_all_symbols:n Map over all available symbols
2522 \cs_new_protected:Nn \stex_all_symbols:n {
2523   \def \__stex_symdecl_all_symbols_cs ##1 {#1}
2524   \seq_map_inline:Nn \l_stex_all_modules_seq {
2525     \seq_map_inline:cn{c_stex_module_##1_constants}{
2526       \__stex_symdecl_all_symbols_cs{##1?####1}
2527     }
2528   }
2529 }
```

(End definition for `\stex_all_symbols:n`. This function is documented on page 91.)

`\STEXsymbol`

```
2530 \NewDocumentCommand \STEXsymbol { m } {  
2531   \stex_get_symbol:n { #1 }  
2532   \exp_args:No  
2533   \stex_invoke_symbol:n { \l_stex_get_symbol_uri_str }  
2534 }
```

(End definition for `\STEXsymbol`. This function is documented on page 92.)

`symdecl` arguments:

```
2535 \keys_define:nn { stex / symdecl } {  
2536   name      .str_set_x:N = \l_stex_symdecl_name_str ,  
2537   args      .str_set_x:N = \l_stex_symdecl_args_str ,  
2538   type      .tl_set:N    = \l_stex_symdecl_type_tl ,  
2539   deprecate .str_set_x:N = \l_stex_symdecl_deprecate_str ,  
2540   align     .str_set:N    = \l_stex_symdecl_align_str , % TODO(?)  
2541   gfc       .str_set:N    = \l_stex_symdecl_gfc_str , % TODO(?)  
2542   def       .tl_set:N    = \l_stex_symdecl_definiens_tl ,  
2543   reorder   .str_set_x:N = \l_stex_symdecl_reorder_str ,  
2544   argnames  .clist_set:N = \l_stex_symdecl_argnames_clist ,  
2545   assoc     .choices:nn  =  
2546             {bin,binl,binr,pre,conj,pwconj}  
2547             {\str_set:Nx \l_stex_symdecl_assoctype_str {\l_keys_choice_tl}}  
2548 }  
2549  
2550 \bool_new:N \l_stex_symdecl_make_macro_bool  
2551  
2552 \cs_new_protected:Nn \__stex_symdecl_args:n {  
2553   \str_clear:N \l_stex_symdecl_name_str  
2554   \str_clear:N \l_stex_symdecl_args_str  
2555   \str_clear:N \l_stex_symdecl_deprecate_str  
2556   \str_clear:N \l_stex_symdecl_reorder_str  
2557   \str_clear:N \l_stex_symdecl_assoctype_str  
2558   \bool_set_false:N \l_stex_symdecl_local_bool  
2559   \tl_clear:N \l_stex_symdecl_type_tl  
2560   \tl_clear:N \l_stex_symdecl_definiens_tl  
2561   \clist_clear:N \l_stex_symdecl_argnames_clist  
2562  
2563   \keys_set:nn { stex / symdecl } { #1 }  
2564 }
```

`\symdecl` Parses the optional arguments and passes them on to `\stex_symdecl_do:` (so that `\symdef` can do the same)

```
2565  
2566 \NewDocumentCommand \symdecl { s m O{} } {  
2567   \__stex_symdecl_args:n { #3 }  
2568   \IfBooleanTF #1 {  
2569     \bool_set_false:N \l_stex_symdecl_make_macro_bool  
2570   } {  
2571     \bool_set_true:N \l_stex_symdecl_make_macro_bool  
2572   }  
2573   \stex_symdecl_do:n { #2 }  
2574   \stex_smsmode_do:  
2575 }
```

```

2576
2577 \cs_new_protected:Nn \stex_symdecl_do:nn {
2578   \__stex_symdecl_args:n{#1}
2579   \bool_set_false:N \l_stex_symdecl_make_macro_bool
2580   \stex_symdecl_do:n{#2}
2581 }
2582
2583 \stex_deactivate_macro:Nn \symdecl {module-environments}

```

(End definition for \symdecl. This function is documented on page 90.)

\stex_symdecl_do:n

```

2584 \cs_new_protected:Nn \stex_symdecl_do:n {
2585   \stex_if_in_module:F {
2586     % TODO throw error? some default namespace?
2587   }
2588
2589   \str_if_empty:NT \l_stex_symdecl_name_str {
2590     \str_set:Nx \l_stex_symdecl_name_str { #1 }
2591   }
2592
2593   \prop_if_exist:cT { l_stex_symdecl_
2594     \l_stex_current_module_str ?
2595     \l_stex_symdecl_name_str
2596   _prop
2597 }{
2598   % TODO throw error (beware of circular dependencies)
2599 }
2600
2601 \prop_clear:N \l_tmpa_prop
2602 \prop_put:Nnx \l_tmpa_prop { module } { \l_stex_current_module_str }
2603 \seq_clear:N \l_tmpa_seq
2604 \prop_put:Nno \l_tmpa_prop { name } \l_stex_symdecl_name_str
2605 \prop_put:Nno \l_tmpa_prop { type } \l_stex_symdecl_type_tl
2606
2607 \str_if_empty:NT \l_stex_symdecl_deprecate_str {
2608   \str_if_empty:NF \l_stex_module_deprecate_str {
2609     \str_set_eq:NN \l_stex_symdecl_deprecate_str \l_stex_module_deprecate_str
2610   }
2611 }
2612 \prop_put:Nno \l_tmpa_prop { deprecate } \l_stex_symdecl_deprecate_str
2613
2614 \exp_args:No \stex_add_constant_to_current_module:n {
2615   \l_stex_symdecl_name_str
2616 }
2617
2618 % arity/args
2619 \int_zero:N \l_tmpb_int
2620
2621 \bool_set_true:N \l_tmpa_bool
2622 \str_map_inline:Nn \l_stex_symdecl_args_str {
2623   \token_case_meaning:NnF ##1 {
2624     0 {} 1 {} 2 {} 3 {} 4 {} 5 {} 6 {} 7 {} 8 {} 9 {}
2625     {\tl_to_str:n i} { \bool_set_false:N \l_tmpa_bool }

```

```

2626     {\tl_to_str:n b} { \bool_set_false:N \l_tmpa_bool }
2627     {\tl_to_str:n a} {
2628         \bool_set_false:N \l_tmpa_bool
2629         \int_incr:N \l_tmpb_int
2630     }
2631     {\tl_to_str:n B} {
2632         \bool_set_false:N \l_tmpa_bool
2633         \int_incr:N \l_tmpb_int
2634     }
2635 }{
2636     \msg_error:nnxx{stex}{error/wrongargs}{
2637         \l_stex_current_module_str ?
2638         \l_stex_symdecl_name_str
2639     }{##1}
2640 }
2641 }
2642
2643 \bool_if:NTF \l_tmpa_bool {
2644     % possibly numeric
2645     \str_if_empty:NTF \l_stex_symdecl_args_str {
2646         \prop_put:Nnn \l_tmpa_prop { args } {}
2647         \prop_put:Nnn \l_tmpa_prop { arity } { 0 }
2648     }{
2649         \int_set:Nn \l_tmpa_int { \l_stex_symdecl_args_str }
2650         \prop_put:Nnx \l_tmpa_prop { arity } { \int_use:N \l_tmpa_int }
2651         \str_clear:N \l_tmpa_str
2652         \int_step_inline:nn \l_tmpa_int {
2653             \str_put_right:Nn \l_tmpa_str i
2654         }
2655         \prop_put:Nnx \l_tmpa_prop { args } { \l_tmpa_str }
2656     }
2657 } {
2658     \prop_put:Nnx \l_tmpa_prop { args } { \l_stex_symdecl_args_str }
2659     \prop_put:Nnx \l_tmpa_prop { arity }
2660     { \str_count:N \l_stex_symdecl_args_str }
2661 }
2662 \prop_put:Nnx \l_tmpa_prop { assocs } { \int_use:N \l_tmpb_int }
2663
2664 \tl_if_empty:NTF \l_stex_symdecl_definiens_tl {
2665     \prop_put:Nnx \l_tmpa_prop { defined }{ false }
2666 }{
2667     \prop_put:Nnx \l_tmpa_prop { defined }{ true }
2668 }
2669
2670 % argnames
2671
2672 \clist_clear:N \l_tmpa_clist
2673 \int_step_inline:nn {\prop_item:Nn \l_tmpa_prop {arity}} {
2674     \clist_if_empty:NTF \l_stex_symdecl_argnames_clist {
2675         \clist_put_right:Nn \l_tmpa_clist {##1}
2676     }{
2677         \clist_pop:NN \l_stex_symdecl_argnames_clist \l_tmpa_tl
2678         \exp_args:NNx \clist_put_right:Nn \l_tmpa_clist {\c_dollar_str\l_tmpa_tl}
2679     }

```

```

2680 }
2681 \prop_put:Nn \l_tmpa_prop {argnames} {\clist_use:Nn \l_tmpa_clist ,}
2682
2683 % semantic macro
2684
2685 \bool_if:NT \l_stex_symdecl_make_macro_bool {
2686   \exp_args:Nx \stex_do_up_to_module:n {
2687     \tl_set:cn { #1 } { \stex_invoke_symbol:n {
2688       \l_stex_current_module_str ? \l_stex_symdecl_name_str
2689     }}
2690   }
2691 }
2692
2693 \stex_debug:nn{symbols}{New~symbol:~
2694   \l_stex_current_module_str ? \l_stex_symdecl_name_str^^J
2695   Type:~\exp_not:o { \l_stex_symdecl_type_tl }^^J
2696   Args:~\prop_item:Nn \l_tmpa_prop { args }^^J
2697   Definiens:~\exp_not:o {\l_stex_symdecl_definiens_tl}
2698 }
2699
2700 % circular dependencies require this:
2701 \stex_if_do_html:T {
2702   \stex_annotate_invisible:nnn {symdecl} {
2703     \l_stex_current_module_str ? \l_stex_symdecl_name_str
2704   } {
2705     \tl_if_empty:NF \l_stex_symdecl_type_tl {
2706       \stex_annotate_invisible:nnn{type}{\l_stex_symdecl_type_tl$}
2707     }
2708     \stex_annotate_invisible:nnn{args}{\prop_item:Nn \l_tmpa_prop { args }}{}
2709     \stex_annotate_invisible:nnn{macroname}{#1}{}
2710     \tl_if_empty:NF \l_stex_symdecl_definiens_tl {
2711       \stex_annotate_invisible:nnn{definiens}{}
2712       {\l_stex_symdecl_definiens_tl$}
2713     }
2714     \str_if_empty:NF \l_stex_symdecl_assoc_type_str {
2715       \stex_annotate_invisible:nnn{assoc_type}{\l_stex_symdecl_assoc_type_str}{}
2716     }
2717     \str_if_empty:NF \l_stex_symdecl_reorder_str {
2718       \stex_annotate_invisible:nnn{reorderargs}{\l_stex_symdecl_reorder_str}{}
2719     }
2720   }
2721 }
2722 \prop_if_exist:cF {
2723   \l_stex_symdecl_
2724   \l_stex_current_module_str ? \l_stex_symdecl_name_str
2725   _prop
2726 } {
2727   \bool_if:NTF \l_stex_symdecl_local_bool \stex_do_up_to_module:x \stex_execute_in_module:
2728     \__stex_symdecl_restore_symbol:nnnnnnnn
2729     {\l_stex_symdecl_name_str}
2730     { \prop_item:Nn \l_tmpa_prop {args} }
2731     { \prop_item:Nn \l_tmpa_prop {arity} }
2732     { \prop_item:Nn \l_tmpa_prop {assoc} }
2733     { \prop_item:Nn \l_tmpa_prop {defined} }

```

```

2734         {\bool_if:NT \l_stex_symdecl_make_macro_bool {#1} }
2735         {\l_stex_current_module_str}
2736         { \prop_item:Nn \l_tmpa_prop {argnames} }
2737     }
2738 }
2739 }
2740 \cs_new_protected:Nn \__stex_symdecl_restore_symbol:nnnnnnnn {
2741     \prop_clear:N \l_tmpa_prop
2742     \prop_put:Nnn \l_tmpa_prop { module } { #7 }
2743     \prop_put:Nnn \l_tmpa_prop { name } { #1 }
2744     \prop_put:Nnn \l_tmpa_prop { args } { #2 }
2745     \prop_put:Nnn \l_tmpa_prop { arity } { #3 }
2746     \prop_put:Nnn \l_tmpa_prop { assocs } { #4 }
2747     \prop_put:Nnn \l_tmpa_prop { defined } { #5 }
2748     \prop_put:Nnn \l_tmpa_prop { argnames } { #8 }
2749     \tl_if_empty:nF{#6}{
2750         \tl_set:cx{#6}{\stex_invoke_symbol:n{\detokenize{#7 ? #1}}}
2751     }
2752     \prop_set_eq:cN{\l_stex_symdecl_ \detokenize{#7 ? #1} _prop}\l_tmpa_prop
2753     \seq_clear:c{\l_stex_symdecl_ \detokenize{#7 ? #1} _notations}
2754 }

```

(End definition for `\stex_symdecl_do:n`. This function is documented on page 91.)

`\textsymdecl`

```

2755
2756 \keys_define:nn { stex / textsymdecl } {
2757     name      .str_set_x:N = \l__stex_symdecl_name_str ,
2758     type      .tl_set:N    = \l__stex_symdecl_type_tl
2759 }
2760
2761 \cs_new_protected:Nn \stex_textsymdecl_args:n {
2762     \str_clear:N \l__stex_symdecl_name_str
2763     \tl_clear:N \l__stex_symdecl_type_tl
2764     \clist_clear:N \l_stex_symdecl_argnames_clist
2765     \keys_set:nn { stex / textsymdecl } { #1 }
2766 }
2767
2768 \NewDocumentCommand \textsymdecl {m O{} m} {
2769     \stex_textsymdecl_args:n { #2 }
2770     \str_if_empty:NTF \l__stex_symdecl_name_str {
2771         \__stex_symdecl_args:n{name=#1,#2}
2772     }{
2773         \__stex_symdecl_args:n{#2}
2774     }
2775     \bool_set_true:N \l_stex_symdecl_make_macro_bool
2776     \stex_symdecl_do:n{#1-sym}
2777     \stex_execute_in_module:n{
2778         \cs_set_nopar:cpn{#1name}{
2779             \ifvmode\hbox_unpack:N\c_empty_box\fi
2780             \ifmmode\hbox{#3}\else#3\fi\hspace
2781         }
2782         \cs_set_nopar:cpn{#1}{
2783             \ifmmode\csname#1-sym\expandafter\endcsname\else

```



```

2784     \ifvmode\hbox_unpack:N\c_empty_box\fi
2785     \symref{#1-sym}{#3}\expandafter\xspace
2786     \fi
2787   }
2788 }
2789 \stex_execute_in_module:x{
2790   \__stex_notation_restore_notation:nnnnn
2791   {\l_stex_current_module_str?\tl_if_empty:NTF\l__stex_symdecl_name_str{#1}\l__stex_symdecl_name_str{#1}}{0}
2792   {\exp_not:n{\STEXInternalTermMathOMSiiii{\STEXInternalCurrentSymbolStr}{}}{\neginfprec}{\neginfprec}}{0}
2793   \comp{\hbox{#3}}\STEXInternalSymbolAfterInvokationTL
2794   }}}
2795   {}
2796 }
2797 }
2798 \stex_smsmode_do:
2799 }

```

(End definition for `\textsymdecl`. This function is documented on page 23.)

`\stex_get_symbol:n`

```

2800 \str_new:N \l_stex_get_symbol_uri_str
2801
2802 \cs_new_protected:Nn \stex_get_symbol:n {
2803   \tl_if_head_eq_catcode:nNTF { #1 } \relax {
2804     \tl_set:Nn \l_tmpa_tl { #1 }
2805     \__stex_symdecl_get_symbol_from_cs:
2806   }{
2807     % argument is a string
2808     % is it a command name?
2809     \cs_if_exist:cTF { #1 }{
2810       \cs_set_eq:Nc \l_tmpa_tl { #1 }
2811       \str_set:Nx \l_tmpa_str { \cs_argument_spec:N \l_tmpa_tl }
2812       \str_if_empty:NTF \l_tmpa_str {
2813         \exp_args:Nx \cs_if_eq:NNTF {
2814           \tl_head:N \l_tmpa_tl
2815         } \stex_invoke_symbol:n {
2816           \__stex_symdecl_get_symbol_from_cs:
2817         }{
2818           \__stex_symdecl_get_symbol_from_string:n { #1 }
2819         }
2820       } {
2821         \__stex_symdecl_get_symbol_from_string:n { #1 }
2822       }
2823     }{
2824       % argument is not a command name
2825       \__stex_symdecl_get_symbol_from_string:n { #1 }
2826       % \l_stex_all_symbols_seq
2827     }
2828   }
2829   \str_if_eq:eeF {
2830     \prop_item:cn {
2831       \l_stex_symdecl\l_stex_get_symbol_uri_str _prop
2832     }{ deprecate }
2833   }{}{

```

```

2834     \msg_warning:nnxx{stex}{warning/deprecated}{
2835       Symbol~\l_stex_get_symbol_uri_str
2836     }{
2837       \prop_item:cn {l_stex_symdecl_l\l_stex_get_symbol_uri_str _prop}{ deprecate }
2838     }
2839   }
2840 }
2841
2842 \cs_new_protected:Nn \__stex_symdecl_get_symbol_from_string:n {
2843   \tl_set:Nn \l_tmpa_tl {
2844     \msg_error:nnn{stex}{error/unknownsymbol}{#1}
2845   }
2846   \str_set:Nn \l_tmpa_str { #1 }
2847
2848   %\int_set:Nn \l_tmpa_int { \str_count:N \l_tmpa_str }
2849
2850   \str_if_in:NnTF \l_tmpa_str ? {
2851     \exp_args:NNno \seq_set_split:Nnn \l_tmpa_seq ? \l_tmpa_str
2852     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
2853     \str_set:Nx \l_tmpb_str {\seq_use:Nn \l_tmpa_seq ?}
2854   }{
2855     \str_clear:N \l_tmpb_str
2856   }
2857   \str_if_empty:NnTF \l_tmpb_str {
2858     \seq_map_inline:Nn \l_stex_all_modules_seq {
2859       \seq_map_inline:cn{c_stex_module_##1_constants}{
2860         \exp_args:Nno \str_if_eq:nnT{####1} \l_tmpa_str {
2861           \seq_map_break:n{\seq_map_break:n{
2862             \tl_set:Nn \l_tmpa_tl {
2863               \str_set:Nn \l_stex_get_symbol_uri_str { ##1 ? ####1 }
2864             }
2865           }}
2866         }
2867       }
2868     }
2869   }{
2870     \int_set:Nn \l_tmpa_int { \str_count:N \l_tmpb_str }
2871     \seq_map_inline:Nn \l_stex_all_modules_seq {
2872       \str_if_eq:eeT{ \l_tmpb_str }{ \str_range:nnn {##1}{-\l_tmpa_int}{-1}}{
2873         \seq_map_inline:cn{c_stex_module_##1_constants}{
2874           \exp_args:Nno \str_if_eq:nnT{####1} \l_tmpa_str {
2875             \seq_map_break:n{\seq_map_break:n{
2876               \tl_set:Nn \l_tmpa_tl {
2877                 \str_set:Nn \l_stex_get_symbol_uri_str { ##1 ? ####1 }
2878               }
2879             }}
2880           }
2881         }
2882       }
2883     }
2884   }
2885
2886   \l_tmpa_tl
2887 }

```

```

2888
2889 \cs_new_protected:Nn \__stex_symdecl_get_symbol_from_cs: {
2890   \exp_args:NNx \tl_set:Nn \l_tmpa_tl
2891     { \tl_tail:N \l_tmpa_tl }
2892   \tl_if_single:NTF \l_tmpa_tl {
2893     \exp_args:No \tl_if_head_is_group:nTF \l_tmpa_tl {
2894       \exp_after:wN \str_set:Nn \exp_after:wN
2895         \l_stex_get_symbol_uri_str \l_tmpa_tl
2896     }{
2897       % TODO
2898       % tail is not a single group
2899     }
2900   }{
2901     % TODO
2902     % tail is not a single group
2903   }
2904 }

```

(End definition for `\stex_get_symbol:n`. This function is documented on page 91.)

31.2 Notations

```

2905 <@@=stex_notation>
      notation arguments:
2906 \keys_define:nn { stex / notation } {
2907   % lang      .tl_set_x:N = \l__stex_notation_lang_str ,
2908   variant .tl_set_x:N = \l__stex_notation_variant_str ,
2909   prec     .str_set_x:N = \l__stex_notation_prec_str ,
2910   op       .tl_set:N = \l__stex_notation_op_tl ,
2911   primary .bool_set:N = \l__stex_notation_primary_bool ,
2912   primary .default:n = {true} ,
2913   hints    .str_set_x:N = \l__stex_notation_hints_str,
2914   unknown .code:n = \str_set:Nx
2915     \l__stex_notation_variant_str \l_keys_key_str
2916 }
2917
2918 \cs_new_protected:Nn \_stex_notation_args:n {
2919   % \str_clear:N \l__stex_notation_lang_str
2920   \str_clear:N \l__stex_notation_variant_str
2921   \str_clear:N \l__stex_notation_prec_str
2922   \str_clear:N \l__stex_notation_hints_str
2923   \tl_clear:N \l__stex_notation_op_tl
2924   \bool_set_false:N \l__stex_notation_primary_bool
2925
2926   \keys_set:nn { stex / notation } { #1 }
2927 }

```

\notation

```

2928 \NewDocumentCommand \notation { s m O{}} {
2929   \_stex_notation_args:n { #3 }
2930   \tl_clear:N \l_stex_symdecl_definiens_tl
2931   \stex_get_symbol:n { #2 }
2932   \tl_set:Nn \l_stex_notation_after_do_tl {

```

```

2933 \__stex_notation_final:
2934 \IfBooleanTF#1{
2935   \stex_setnotation:n {\l_stex_get_symbol_uri_str}
2936 }{}
2937 \stex_smsmode_do:\ignorespacesandpars
2938 }
2939 \stex_notation_do:nnnnn
2940 { \prop_item:cn {\l_stex_symdecl\l_stex_get_symbol_uri_str _prop } { args } }
2941 { \prop_item:cn { \l_stex_symdecl\l_stex_get_symbol_uri_str _prop } { arity } }
2942 { \l__stex_notation_variant_str }
2943 { \l__stex_notation_prec_str }
2944 }
2945 \stex_deactivate_macro:Nn \notation {module-environments}

```

(End definition for \notation. This function is documented on page 91.)

\stex_notation_do:nnnnn

```

2946 \seq_new:N \l__stex_notation_precedences_seq
2947 \tl_new:N \l__stex_notation_opprec_tl
2948 \int_new:N \l__stex_notation_currarg_int
2949 \tl_new:N \STEXInternalSymbolAfterInvokationTL
2950
2951 \cs_new_protected:Nn \stex_notation_do:nnnnn {
2952   \let\STEXInternalCurrentSymbolStr\relax
2953   \seq_clear:N \l__stex_notation_precedences_seq
2954   \tl_clear:N \l__stex_notation_opprec_tl
2955   \str_set:Nx \l__stex_notation_args_str { #1 }
2956   \str_set:Nx \l__stex_notation_arity_str { #2 }
2957   \str_set:Nx \l__stex_notation_suffix_str { #3 }
2958   \str_set:Nx \l__stex_notation_prec_str { #4 }
2959
2960   % precedences
2961   \str_if_empty:NTF \l__stex_notation_prec_str {
2962     \int_compare:nNnTF \l__stex_notation_arity_str = 0 {
2963       \tl_set:No \l__stex_notation_opprec_tl { \neginfprec }
2964     }{
2965       \tl_set:Nn \l__stex_notation_opprec_tl { 0 }
2966     }
2967   } {
2968     \str_if_eq:onTF \l__stex_notation_prec_str {nobrackets}{
2969       \tl_set:No \l__stex_notation_opprec_tl { \neginfprec }
2970       \int_step_inline:nn { \l__stex_notation_arity_str } {
2971         \exp_args:NNo
2972         \seq_put_right:Nn \l__stex_notation_precedences_seq { \infprec }
2973       }
2974     }{
2975       \seq_set_split:NnV \l_tmpa_seq ; \l__stex_notation_prec_str
2976       \seq_pop_left:NNTF \l_tmpa_seq \l_tmpa_str {
2977         \tl_set:No \l__stex_notation_opprec_tl { \l_tmpa_str }
2978         \seq_pop_left:NNT \l_tmpa_seq \l_tmpa_str {
2979           \exp_args:NNNo \exp_args:NNno \seq_set_split:Nnn
2980             \l_tmpa_seq {\tl_to_str:n{x}} } { \l_tmpa_str }
2981         \seq_map_inline:Nn \l_tmpa_seq {
2982           \seq_put_right:Nn \l__stex_notation_precedences_seq { ##1 }

```

```

2983     }
2984   }
2985   }{
2986     \int_compare:nNnTF \l__stex_notation_arity_str = 0 {
2987       \tl_set:No \l__stex_notation_opprec_tl { \infprec }
2988     }{
2989       \tl_set:No \l__stex_notation_opprec_tl { 0 }
2990     }
2991   }
2992 }
2993 }
2994
2995 \seq_set_eq:NN \l_tmpa_seq \l__stex_notation_precedences_seq
2996 \int_step_inline:nn { \l__stex_notation_arity_str } {
2997   \seq_pop_left:NNF \l_tmpa_seq \l_tmpb_str {
2998     \exp_args:NNo
2999     \seq_put_right:No \l__stex_notation_precedences_seq {
3000       \l__stex_notation_opprec_tl
3001     }
3002   }
3003 }
3004 \tl_clear:N \l_stex_notation_dummyargs_tl
3005
3006 \int_compare:nNnTF \l__stex_notation_arity_str = 0 {
3007   \exp_args:NNe
3008   \cs_set:Npn \l_stex_notation_macrocode_cs {
3009     \STEXInternalTermMathOMSiiii { \STEXInternalCurrentSymbolStr }
3010     { \l__stex_notation_suffix_str }
3011     { \l__stex_notation_opprec_tl }
3012     { \exp_not:n { #5 } }
3013   }
3014   \l_stex_notation_after_do_tl
3015 }{
3016   \str_if_in:NnTF \l__stex_notation_args_str b {
3017     \exp_args:Nne \use:nn
3018     {
3019       \cs_generate_from_arg_count:NNnn \l_stex_notation_macrocode_cs
3020       \cs_set:Npn \l__stex_notation_arity_str } { {
3021         \STEXInternalTermMathOMBiiii { \STEXInternalCurrentSymbolStr }
3022         { \l__stex_notation_suffix_str }
3023         { \l__stex_notation_opprec_tl }
3024         { \exp_not:n { #5 } }
3025       }
3026     }{
3027       \str_if_in:NnTF \l__stex_notation_args_str B {
3028         \exp_args:Nne \use:nn
3029         {
3030           \cs_generate_from_arg_count:NNnn \l_stex_notation_macrocode_cs
3031           \cs_set:Npn \l__stex_notation_arity_str } { {
3032             \STEXInternalTermMathOMBiiii { \STEXInternalCurrentSymbolStr }
3033             { \l__stex_notation_suffix_str }
3034             { \l__stex_notation_opprec_tl }
3035             { \exp_not:n { #5 } }
3036           } }

```

```

3037   }{
3038     \exp_args:Nne \use:nn
3039     {
3040       \cs_generate_from_arg_count:NNnn \l_stex_notation_macrocode_cs
3041       \cs_set:Npn \l__stex_notation_arity_str } { {
3042         \STEXInternalTermMathOMAiiiii { \STEXInternalCurrentSymbolStr }
3043         { \l__stex_notation_suffix_str }
3044         { \l__stex_notation_opprec_tl }
3045         { \exp_not:n { #5 } }
3046       } }
3047     }
3048   }
3049
3050   \str_set_eq:NN \l__stex_notation_remaining_args_str \l__stex_notation_args_str
3051   \int_zero:N \l__stex_notation_currarg_int
3052   \seq_set_eq:NN \l__stex_notation_remaining_precs_seq \l__stex_notation_precedences_seq
3053   \__stex_notation_arguments:
3054 }
3055 }

```

(End definition for `\stex_notation_do:nnnnn`. This function is documented on page ??.)

`__stex_notation_arguments:` Takes care of annotating the arguments in a notation macro

```

3056 \cs_new_protected:Nn \__stex_notation_arguments: {
3057   \int_incr:N \l__stex_notation_currarg_int
3058   \str_if_empty:NTF \l__stex_notation_remaining_args_str {
3059     \l_stex_notation_after_do_tl
3060   }{
3061     \str_set:Nx \l_tmpa_str { \str_head:N \l__stex_notation_remaining_args_str }
3062     \str_set:Nx \l__stex_notation_remaining_args_str { \str_tail:N \l__stex_notation_remaini
3063     \str_if_eq:VnTF \l_tmpa_str a {
3064       \__stex_notation_argument_assoc:nn{a}
3065     }{
3066       \str_if_eq:VnTF \l_tmpa_str B {
3067         \__stex_notation_argument_assoc:nn{B}
3068       }{
3069         \seq_pop_left:NN \l__stex_notation_remaining_precs_seq \l_tmpb_str
3070         \tl_put_right:Nx \l_stex_notation_dummyargs_tl {
3071           { \STEXInternalTermMathArgiii
3072             { \l_tmpa_str\int_use:N \l__stex_notation_currarg_int }
3073             { \l_tmpb_str }
3074             { ####\int_use:N \l__stex_notation_currarg_int }
3075           }
3076         }
3077         \__stex_notation_arguments:
3078       }
3079     }
3080   }
3081 }

```

(End definition for `__stex_notation_arguments:.`)

`__stex_notation_argument_assoc:nn`

```

3082 \cs_new_protected:Nn \__stex_notation_argument_assoc:nn {

```

```

3083
3084 \cs_generate_from_arg_count:NNnn \l_tmpa_cs \cs_set:Npn
3085   {\l__stex_notation_arity_str}{
3086     #2
3087   }
3088 \int_zero:N \l_tmpa_int
3089 \tl_clear:N \l_tmpa_tl
3090 \str_map_inline:Nn \l__stex_notation_args_str {
3091   \int_incr:N \l_tmpa_int
3092   \tl_put_right:Nx \l_tmpa_tl {
3093     \str_if_eq:nnTF {##1}{a}{ {} }{
3094       \str_if_eq:nnTF {##1}{B}{ {} }{
3095         {\_stex_term_arg:nn{##1}\int_use:N \l_tmpa_int}{##### \int_use:N \l_tmpa_int}
3096       }
3097     }
3098   }
3099 }
3100 \exp_after:wN\exp_after:wN\exp_after:wN \def
3101 \exp_after:wN\exp_after:wN\exp_after:wN \l_tmpa_cs
3102 \exp_after:wN\exp_after:wN\exp_after:wN ##
3103 \exp_after:wN\exp_after:wN\exp_after:wN 1
3104 \exp_after:wN\exp_after:wN\exp_after:wN ##
3105 \exp_after:wN\exp_after:wN\exp_after:wN 2
3106 \exp_after:wN\exp_after:wN\exp_after:wN {
3107   \exp_after:wN \exp_after:wN \exp_after:wN
3108   \exp_not:n \exp_after:wN \exp_after:wN \exp_after:wN {
3109     \exp_after:wN \l_tmpa_cs \l_tmpa_tl
3110   }
3111 }
3112
3113 \seq_pop_left:NN \l__stex_notation_remaining_precs_seq \l_tmpa_str
3114 \tl_put_right:Nx \l_stex_notation_dummyargs_tl { {
3115   \STEXInternalTermMathAssocArgiiii
3116   { \int_use:N \l__stex_notation_currarg_int }
3117   { \l_tmpa_str }
3118   { ####\int_use:N \l__stex_notation_currarg_int }
3119   { \l_tmpa_cs {####1} {####2} }
3120   {#1}
3121 } }
3122 \__stex_notation_arguments:
3123 }

```

(End definition for _stex_notation_argument_assoc:nn.)

_stex_notation_final: Called after processing all notation arguments

```

3124 \cs_new_protected:Nn \__stex_notation_restore_notation:nnnnn {
3125   \cs_generate_from_arg_count:cNnn{stex_notation_\detokenize{#1} \c_hash_str \detokenize{#2}}
3126   \cs_set_nopar:Npn {#3}{#4}
3127   \tl_if_empty:nF {#5}{
3128     \tl_set:cn{stex_op_notation_\detokenize{#1} \c_hash_str \detokenize{#2}_cs}{ \comp{ #5 }
3129   }
3130   \seq_if_exist:cT { l_stex_symdecl_\detokenize{#1} _notations }{
3131     \seq_put_right:cx { l_stex_symdecl_\detokenize{#1} _notations } { \detokenize{#2} }
3132   }

```

```

3133 }
3134
3135 \cs_new_protected:Nn \__stex_notation_final: {
3136
3137   \stex_execute_in_module:x {
3138     \__stex_notation_restore_notation:nnnnn
3139     {\l_stex_get_symbol_uri_str}
3140     {\l__stex_notation_suffix_str}
3141     {\l__stex_notation_arity_str}
3142     {
3143       \exp_after:wN \exp_after:wN \exp_after:wN
3144       \exp_not:n \exp_after:wN \exp_after:wN \exp_after:wN
3145       { \exp_after:wN \l_stex_notation_macrocode_cs \l_stex_notation_dummyargs_tl \STEXInt
3146     }
3147     {\exp_args:No \exp_not:n \l__stex_notation_op_tl }
3148   }
3149
3150   \stex_debug:nn{symbols}{
3151     Notation~\l__stex_notation_suffix_str
3152     ~for~\l_stex_get_symbol_uri_str^^J
3153     Operator~precedence:~\l__stex_notation_opprec_tl^^J
3154     Argument~precedences:~
3155     \seq_use:Nn \l__stex_notation_precedences_seq {,~}^^J
3156     Notation: \cs_meaning:c {
3157       stex_notation_ \l_stex_get_symbol_uri_str \c_hash_str
3158       \l__stex_notation_suffix_str
3159       _cs
3160     }
3161   }
3162   % HTML annotations
3163   \stex_if_do_html:T {
3164     \stex_annotate_invisible:nnn { notation }
3165     { \l_stex_get_symbol_uri_str } {
3166       \stex_annotate_invisible:nnn { notationfragment }
3167       { \l__stex_notation_suffix_str }{}
3168       \stex_annotate_invisible:nnn { precedence }
3169       { \l__stex_notation_prec_str }{}
3170
3171       \int_zero:N \l_tmpa_int
3172       \str_set_eq:NN \l__stex_notation_remaining_args_str \l__stex_notation_args_str
3173       \tl_clear:N \l_tmpa_tl
3174       \int_step_inline:nn { \l__stex_notation_arity_str }{
3175         \int_incr:N \l_tmpa_int
3176         \str_set:Nx \l_tmpb_str { \str_head:N \l__stex_notation_remaining_args_str }
3177         \str_set:Nx \l__stex_notation_remaining_args_str { \str_tail:N \l__stex_notation_rema
3178         \str_if_eq:VnTF \l_tmpb_str a {
3179           \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3180             \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int a}{} ,
3181             \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int b}{}
3182           } }
3183         }{
3184           \str_if_eq:VnTF \l_tmpb_str B {
3185             \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3186               \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int a}{} ,

```



```

3187         \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int b}{\}
3188     } }
3189   }{
3190     \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3191       \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int}{\}
3192     } }
3193   }
3194 }
3195 }
3196 \stex_annotate_invisible:nnn { notationcomp }{\}{
3197   \str_set:Nx \STEXInternalCurrentSymbolStr {\l_stex_get_symbol_uri_str }
3198   $ \exp_args:Nno \use:nn { \use:c {
3199     stex_notation_ \STEXInternalCurrentSymbolStr
3200     \c_hash_str \l__stex_notation_suffix_str_cs
3201   } } { \l_tmpa_tl } $
3202 }
3203 \tl_if_empty:NF \l__stex_notation_op_tl {
3204   \stex_annotate_invisible:nnn { notationopcomp }{\}{
3205     $\l__stex_notation_op_tl$
3206   }
3207 }
3208 }
3209 }
3210 }

```

(End definition for `_stex_notation_final:`.)

`\setnotation`

```

3211 \keys_define:nn { stex / setnotation } {
3212   % lang      .tl_set_x:N = \l__stex_notation_lang_str ,
3213   variant .tl_set_x:N = \l__stex_notation_variant_str ,
3214   unknown .code:n      = \str_set:Nx
3215     \l__stex_notation_variant_str \l_keys_key_str
3216 }
3217
3218 \cs_new_protected:Nn \stex_setnotation_args:n {
3219   % \str_clear:N \l__stex_notation_lang_str
3220   \str_clear:N \l__stex_notation_variant_str
3221   \keys_set:nn { stex / setnotation } { #1 }
3222 }
3223
3224 \cs_new_protected:Nn \__stex_notation_setnotation:nn {
3225   \seq_if_exist:cT{l_stex_symdecl_#1_notations}{
3226     \seq_remove_all:cn { l_stex_symdecl_#1_notations }{ #2 }
3227     \seq_put_left:cn { l_stex_symdecl_#1_notations }{ #2 }
3228   }
3229 }
3230
3231 \cs_new_protected:Nn \stex_setnotation:n {
3232   \exp_args:Nnx \seq_if_in:cnTF { l_stex_symdecl_#1_notations }
3233     { \l__stex_notation_variant_str }{
3234     \stex_execute_in_module:x{ \__stex_notation_setnotation:nn {#1}{\l__stex_notation_vari
3235     \stex_debug:nn {notations}{
3236       Setting~default~notation~

```

```

3237         {\l__stex_notation_variant_str }~for~
3238         #1 \\\
3239         \expandafter\meaning\csname
3240         l_stex_symdecl_#1 _notations\endcsname
3241     }
3242     ){
3243         \msg_error:nnxx{stex}{unknownnotation}{\l__stex_notation_variant_str}{#1}
3244     }
3245 }
3246
3247 \NewDocumentCommand \setnotation {m m} {
3248     \stex_get_symbol:n { #1 }
3249     \_stex_setnotation_args:n { #2 }
3250     \stex_setnotation:n{\l_stex_get_symbol_uri_str}
3251     \stex_smsmode_do:\ignorespacesandpars
3252 }
3253
3254 \cs_new_protected:Nn \stex_copy_notations:nn {
3255     \stex_debug:nn {notations}{
3256         Copying~notations~from~#2~to~#1\\
3257         \seq_use:cn{l_stex_symdecl_#2_notations}{,~}
3258     }
3259     \tl_clear:N \l_tmpa_tl
3260     \int_step_inline:nn { \prop_item:cn {l_stex_symdecl_#2_prop}{ arity } } {
3261         \tl_put_right:Nn \l_tmpa_tl { {##### #1} }
3262     }
3263     \seq_map_inline:cn {l_stex_symdecl_#2_notations}{\begingroup
3264         \stex_debug:nn{Here}{Here:~##1}
3265         \cs_set_eq:Nc \l_tmpa_cs { stex_notation_ #2 \c_hash_str ##1 _cs }
3266         \edef \l_tmpa_tl {
3267             \exp_after:wN\exp_after:wN\exp_after:wN \exp_not:n
3268             \exp_after:wN\exp_after:wN\exp_after:wN {
3269                 \exp_after:wN \l_tmpa_cs \l_tmpa_tl
3270             }
3271         }
3272
3273         \exp_after:wN \def \exp_after:wN \l_tmpa_tl
3274         \exp_after:wN #####\exp_after:wN 1 \exp_after:wN #####\exp_after:wN 2
3275         \exp_after:wN { \l_tmpa_tl }
3276
3277         \edef \l_tmpa_tl {
3278             \exp_after:wN \exp_not:n \exp_after:wN {
3279                 \l_tmpa_tl {##### 1}{##### 2}
3280             }
3281         }
3282
3283         \stex_debug:nn{Here}{Here:~\expandafter\detokenize\expandafter{\l_tmpa_tl}}
3284
3285     \stex_execute_in_module:x {
3286         \_stex_notation_restore_notation:nnnnn
3287         {#1}{##1}
3288         { \prop_item:cn {l_stex_symdecl_#2_prop}{ arity } }
3289         { \exp_after:wN\exp_not:n\exp_after:wN{\l_tmpa_tl} }
3290         {

```

```

3291         \cs_if_exist:cT{stex_op_notation_ #2\c_hash_str ##1 _cs}{
3292             \exp_args:NNo\exp_args:No\exp_not:n{\csname stex_op_notation_ #2\c_hash_str ##1
3293             }
3294         }
3295     }\endgroup
3296 }
3297 }
3298
3299 \NewDocumentCommand \copynotation {m m} {
3300     \stex_get_symbol:n { #1 }
3301     \str_set_eq:NN \l_tmpa_str \l_stex_get_symbol_uri_str
3302     \stex_get_symbol:n { #2 }
3303     \exp_args:Noo
3304     \stex_copy_notations:nn \l_tmpa_str \l_stex_get_symbol_uri_str
3305     \stex_smsmode_do:\ignorespacesandpars
3306 }
3307

```

(End definition for \setnotation. This function is documented on page 23.)

\symdef

```

3308 \keys_define:nn { stex / symdef } {
3309     name .str_set_x:N = \l_stex_symdecl_name_str ,
3310     args .str_set_x:N = \l_stex_symdecl_args_str ,
3311     type .tl_set:N = \l_stex_symdecl_type_tl ,
3312     def .tl_set:N = \l_stex_symdecl_definiens_tl ,
3313     reorder .str_set_x:N = \l_stex_symdecl_reorder_str ,
3314     op .tl_set:N = \l__stex_notation_op_tl ,
3315     % lang .str_set_x:N = \l__stex_notation_lang_str ,
3316     variant .str_set_x:N = \l__stex_notation_variant_str ,
3317     prec .str_set_x:N = \l__stex_notation_prec_str ,
3318     argnames .clist_set:N = \l_stex_symdecl_argnames_clist ,
3319     assoc .choices:nn =
3320         {bin,binl,binr,pre,conj,pwconj}
3321         {\str_set:Nx \l_stex_symdecl_assoctype_str {\l_keys_choice_tl}},
3322     unknown .code:n = \str_set:Nx
3323         \l__stex_notation_variant_str \l_keys_key_str
3324 }
3325
3326 \cs_new_protected:Nn \__stex_notation_symdef_args:n {
3327     \str_clear:N \l_stex_symdecl_name_str
3328     \str_clear:N \l_stex_symdecl_args_str
3329     \str_clear:N \l_stex_symdecl_assoctype_str
3330     \str_clear:N \l_stex_symdecl_reorder_str
3331     \bool_set_false:N \l_stex_symdecl_local_bool
3332     \tl_clear:N \l_stex_symdecl_type_tl
3333     \tl_clear:N \l_stex_symdecl_definiens_tl
3334     \clist_clear:N \l_stex_symdecl_argnames_clist
3335     % \str_clear:N \l__stex_notation_lang_str
3336     \str_clear:N \l__stex_notation_variant_str
3337     \str_clear:N \l__stex_notation_prec_str
3338     \tl_clear:N \l__stex_notation_op_tl
3339
3340     \keys_set:nn { stex / symdef } { #1 }

```

```

3341 }
3342
3343 \NewDocumentCommand \symdef { m O{} } {
3344   \_stex_notation_symdef_args:n { #2 }
3345   \bool_set_true:N \l_stex_symdecl_make_macro_bool
3346   \stex_symdecl_do:n { #1 }
3347   \tl_set:Nn \l_stex_notation_after_do_tl {
3348     \_stex_notation_final:
3349     \stex_smsmode_do:\ignorespacesandpars
3350   }
3351   \str_set:Nx \l_stex_get_symbol_uri_str {
3352     \l_stex_current_module_str ? \l_stex_symdecl_name_str
3353   }
3354   \exp_args:Nx \stex_notation_do:nnnnn
3355     { \prop_item:cn {l_stex_symdecl\l_stex_get_symbol_uri_str_prop } { args } }
3356     { \prop_item:cn {l_stex_symdecl\l_stex_get_symbol_uri_str_prop } { arity } }
3357     { \l__stex_notation_variant_str }
3358     { \l__stex_notation_prec_str}
3359 }
3360 \stex_deactivate_macro:Nn \symdef {module~environments}
3361
3362 \keys_define:nn { stex / mmtdef } {
3363   name .str_set_x:N = \l_stex_symdecl_name_str ,
3364   args .str_set_x:N = \l_stex_symdecl_args_str ,
3365   reorder .str_set_x:N = \l_stex_symdecl_reorder_str ,
3366   op .tl_set:N = \l__stex_notation_op_tl ,
3367   % lang .str_set_x:N = \l__stex_notation_lang_str ,
3368   variant .str_set_x:N = \l__stex_notation_variant_str ,
3369   prec .str_set_x:N = \l__stex_notation_prec_str ,
3370   argnames .clist_set:N = \l_stex_symdecl_argnames_clist ,
3371   assoc .choices:nn =
3372     {bin,binl,binr,pre,conj,pwconj}
3373     {\str_set:Nx \l_stex_symdecl_assoctype_str {\l_keys_choice_tl}},
3374   unknown .code:n = \str_set:Nx
3375     \l__stex_notation_variant_str \l_keys_key_str
3376 }
3377 \cs_new_protected:Nn \_stex_mmtdef_args:n {
3378   \str_clear:N \l_stex_symdecl_name_str
3379   \str_clear:N \l_stex_symdecl_args_str
3380   \str_clear:N \l_stex_symdecl_assoctype_str
3381   \str_clear:N \l_stex_symdecl_reorder_str
3382   \bool_set_false:N \l_stex_symdecl_local_bool
3383   \clist_clear:N \l_stex_symdecl_argnames_clist
3384   % \str_clear:N \l__stex_notation_lang_str
3385   \str_clear:N \l__stex_notation_variant_str
3386   \str_clear:N \l__stex_notation_prec_str
3387   \tl_clear:N \l__stex_notation_op_tl
3388
3389   \keys_set:nn { stex / mmtdef } { #1 }
3390 }
3391
3392 \NewDocumentCommand \mmtdef {m O{} }{
3393   \_stex_mmtdef_args:n{ #2 }
3394   \bool_set_true:N \l_stex_symdecl_make_macro_bool

```

```

3395 \str_if_empty:NT \l_stex_symdecl_name_str {
3396   \str_set:Nx \l_stex_symdecl_name_str { #1 }
3397 }
3398 %\tl_set:Nx \l_stex_symdecl_definiens_tl {
3399 % \stex_annotate:nnn{ OMID }{
3400 %   \l_stex_module_mmtfor_str?\l_stex_symdecl_name_str
3401 % }{}
3402 %}
3403 \stex_symdecl_do:n { #1 }
3404 \stex_if_smsmode:F{
3405   \MMTrule{rules.stex.mmt.kwarc.info?SubstitutionRule}{
3406     \stex_annotate:nnn{ OMID }{
3407       \l_stex_current_module_str ? \l_stex_symdecl_name_str
3408     }{},
3409     \stex_annotate:nnn{ OMID }{
3410       \l_stex_module_mmtfor_str?\l_stex_symdecl_name_str
3411     }{}
3412   }
3413 }
3414 \tl_set:Nn \l_stex_notation_after_do_tl {
3415   \__stex_notation_final:
3416   \stex_smsmode_do:\ignorespacesandpars
3417 }
3418 \str_set:Nx \l_stex_get_symbol_uri_str {
3419   \l_stex_current_module_str ? \l_stex_symdecl_name_str
3420 }
3421 \exp_args:Nx \stex_notation_do:nnnnn
3422 { \prop_item:cn {l_stex_symdecl\l_stex_get_symbol_uri_str _prop } { args } }
3423 { \prop_item:cn { l_stex_symdecl\l_stex_get_symbol_uri_str _prop } { arity } }
3424 { \l__stex_notation_variant_str }
3425 { \l__stex_notation_prec_str}
3426 }

```

(End definition for `\symdef`. This function is documented on page 91.)

31.3 Variables

```

3427 <@@=stex_variables>
3428
3429 \keys_define:nn { stex / vardef } {
3430   name .str_set_x:N = \l__stex_variables_name_str ,
3431   args .str_set_x:N = \l__stex_variables_args_str ,
3432   type .tl_set:N = \l__stex_variables_type_tl ,
3433   def .tl_set:N = \l__stex_variables_def_tl ,
3434   op .tl_set:N = \l__stex_variables_op_tl ,
3435   prec .str_set_x:N = \l__stex_variables_prec_str ,
3436   reorder .str_set_x:N = \l__stex_variables_reorder_str ,
3437   argnames .clist_set:N = \l__stex_variables_argnames_clist ,
3438   assoc .choices:nn =
3439     {bin,binl,binr,pre,conj,pwconj}
3440     {\str_set:Nx \l__stex_variables_assoctype_str {\l_keys_choice_tl}},
3441   bind .choices:nn =
3442     {forall,exists}
3443     {\str_set:Nx \l__stex_variables_bind_str {\l_keys_choice_tl}}

```

```

3444 }
3445
3446 \cs_new_protected:Nn \__stex_variables_args:n {
3447   \str_clear:N \l__stex_variables_name_str
3448   \str_clear:N \l__stex_variables_args_str
3449   \str_clear:N \l__stex_variables_prec_str
3450   \str_clear:N \l__stex_variables_assoctype_str
3451   \str_clear:N \l__stex_variables_reorder_str
3452   \str_clear:N \l__stex_variables_bind_str
3453   \tl_clear:N \l__stex_variables_type_tl
3454   \tl_clear:N \l__stex_variables_def_tl
3455   \tl_clear:N \l__stex_variables_op_tl
3456   \clist_clear:N \l__stex_variables_argnames_clist
3457
3458   \keys_set:nn { stex / vardef } { #1 }
3459 }
3460
3461 \NewDocumentCommand \__stex_variables_do_simple:nnn { m O{} } {
3462   \__stex_variables_args:n {#2}
3463   \str_if_empty:NT \l__stex_variables_name_str {
3464     \str_set:Nx \l__stex_variables_name_str { #1 }
3465   }
3466   \prop_clear:N \l_tmpa_prop
3467   \prop_put:Nno \l_tmpa_prop { name } \l__stex_variables_name_str
3468
3469   \int_zero:N \l_tmpb_int
3470   \bool_set_true:N \l_tmpa_bool
3471   \str_map_inline:Nn \l__stex_variables_args_str {
3472     \token_case_meaning:NnF ##1 {
3473       0 {} 1 {} 2 {} 3 {} 4 {} 5 {} 6 {} 7 {} 8 {} 9 {}
3474       {\tl_to_str:n i} { \bool_set_false:N \l_tmpa_bool }
3475       {\tl_to_str:n b} { \bool_set_false:N \l_tmpa_bool }
3476       {\tl_to_str:n a} {
3477         \bool_set_false:N \l_tmpa_bool
3478         \int_incr:N \l_tmpb_int
3479       }
3480       {\tl_to_str:n B} {
3481         \bool_set_false:N \l_tmpa_bool
3482         \int_incr:N \l_tmpb_int
3483       }
3484     }{
3485       \msg_error:nnxx{stex}{error/wrongargs}{
3486         variable~\l__stex_variables_name_str
3487       }{##1}
3488     }
3489   }
3490   \bool_if:NTF \l_tmpa_bool {
3491     % possibly numeric
3492     \str_if_empty:NTF \l__stex_variables_args_str {
3493       \prop_put:Nnn \l_tmpa_prop { args } {}
3494       \prop_put:Nnn \l_tmpa_prop { arity } { 0 }
3495     }{
3496       \int_set:Nn \l_tmpa_int { \l__stex_variables_args_str }
3497       \prop_put:Nnx \l_tmpa_prop { arity } { \int_use:N \l_tmpa_int }

```

```

3498     \str_clear:N \l_tmpa_str
3499     \int_step_inline:nn \l_tmpa_int {
3500         \str_put_right:Nn \l_tmpa_str i
3501     }
3502     \str_set_eq:NN \l__stex_variables_args_str \l_tmpa_str
3503     \prop_put:Nnx \l_tmpa_prop { args } { \l__stex_variables_args_str }
3504 }
3505 } {
3506     \prop_put:Nnx \l_tmpa_prop { args } { \l__stex_variables_args_str }
3507     \prop_put:Nnx \l_tmpa_prop { arity }
3508     { \str_count:N \l__stex_variables_args_str }
3509 }
3510 \prop_put:Nnx \l_tmpa_prop { assoc } { \int_use:N \l_tmpb_int }
3511 \tl_set:cx { #1 } { \stex_invoke_variable:n { \l__stex_variables_name_str } }
3512
3513 % argnames
3514
3515 \clist_clear:N \l_tmpa_clist
3516 \int_step_inline:nn { \prop_item:Nn \l_tmpa_prop { arity } } {
3517     \clist_if_empty:NTF \l__stex_variables_argnames_clist {
3518         \clist_put_right:Nn \l_tmpa_clist { ##1 }
3519     } {
3520         \clist_pop:NN \l__stex_variables_argnames_clist \l_tmpa_tl
3521         \exp_args:NNx \clist_put_right:Nn \l_tmpa_clist { \c_dollar_str \l_tmpa_tl }
3522     }
3523 }
3524 \prop_put:Nnx \l_tmpa_prop { argnames } { \clist_use:Nn \l_tmpa_clist , }
3525
3526
3527 \prop_set_eq:cN { l_stex_symdecl_var://\l__stex_variables_name_str _prop } \l_tmpa_prop
3528
3529 \tl_if_empty:NF \l__stex_variables_op_tl {
3530     \cs_set:cpx {
3531         stex_var_op_notation_ \l__stex_variables_name_str _cs
3532     } { \exp_not:N \comp { \exp_args:No \exp_not:n { \l__stex_variables_op_tl } } }
3533 }
3534
3535 \tl_set:Nn \l_stex_notation_after_do_tl {
3536     \exp_args:Nne \use:nn {
3537         \cs_generate_from_arg_count:cNnn { stex_var_notation_ \l__stex_variables_name_str _cs }
3538         \cs_set:Npn { \prop_item:Nn \l_tmpa_prop { arity } }
3539     } { {
3540         \exp_after:wN \exp_after:wN \exp_after:wN
3541         \exp_not:n \exp_after:wN \exp_after:wN \exp_after:wN
3542         { \exp_after:wN \l_stex_notation_macrocode_cs \l_stex_notation_dummyargs_tl \STEXInter
3543     } }
3544
3545 \stex_if_do_html:T {
3546     \stex_annotate_invisible:nnn { vardecl } { \l__stex_variables_name_str } {
3547         \stex_annotate_invisible:nnn { precedence }
3548         { \l__stex_variables_prec_str } { }
3549         \tl_if_empty:NF \l__stex_variables_type_tl { \stex_annotate_invisible:nnn { type } { } { $ \
3549         \stex_annotate_invisible:nnn { args } { \l__stex_variables_args_str } { }
3550         \stex_annotate_invisible:nnn { macroname } { #1 } { }
3551         \tl_if_empty:NF \l__stex_variables_def_tl {

```

```

3552     \stex_annotate_invisible:nnn{definiens}{}
3553     {${\l__stex_variables_def_tl$}
3554 }
3555 \str_if_empty:NF \l__stex_variables_assoctype_str {
3556     \stex_annotate_invisible:nnn{assoctype}{\l__stex_variables_assoctype_str}{}
3557 }
3558 \str_if_empty:NF \l__stex_variables_reorder_str {
3559     \stex_annotate_invisible:nnn{reorderargs}{\l__stex_variables_reorder_str}{}
3560 }
3561 \int_zero:N \l_tmpa_int
3562 \str_set_eq:NN \l__stex_variables_remaining_args_str \l__stex_variables_args_str
3563 \tl_clear:N \l_tmpa_tl
3564 \int_step_inline:nn { \prop_item:Nn \l_tmpa_prop { arity } }{
3565     \int_incr:N \l_tmpa_int
3566     \str_set:Nx \l_tmpb_str { \str_head:N \l__stex_variables_remaining_args_str }
3567     \str_set:Nx \l__stex_variables_remaining_args_str { \str_tail:N \l__stex_variables
3568     \str_if_eq:VnTF \l_tmpb_str a {
3569         \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3570             \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int a}{} ,
3571             \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int b}{}
3572         } }
3573     }{
3574         \str_if_eq:VnTF \l_tmpb_str B {
3575             \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3576                 \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int a}{} ,
3577                 \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int b}{}
3578             } }
3579         }{
3580             \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3581                 \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int}{}
3582             } }
3583         }
3584     }
3585 }
3586 \stex_annotate_invisible:nnn { notationcomp }{}{
3587     \str_set:Nx \STEXInternalCurrentSymbolStr {var://\l__stex_variables_name_str }
3588     $ \exp_args:Nno \use:nn { \use:c {
3589         stex_var_notation_\l__stex_variables_name_str_cs
3590     } } { \l_tmpa_tl } $
3591 }
3592 \tl_if_empty:NF \l__stex_variables_op_tl {
3593     \stex_annotate_invisible:nnn { notationopcomp }{}{
3594         ${\l__stex_variables_op_tl$}
3595     }
3596 }
3597 }
3598 \str_if_empty:NF \l__stex_variables_bind_str {
3599     \stex_annotate_invisible:nnn {bindtype}{\l__stex_variables_bind_str,\l__stex_variab
3600 }
3601 }\ignorespacesandpars
3602 }
3603
3604 \stex_notation_do:nnnnn { \l__stex_variables_args_str } { \prop_item:Nn \l_tmpa_prop { ari
3605 }

```



```

3606
3607 \cs_new:Nn \_stex_reset:N {
3608   \tl_if_exist:NTF #1 {
3609     \def \exp_not:N #1 { \exp_args:No \exp_not:n #1 }
3610   }{
3611     \let \exp_not:N #1 \exp_not:N \undefined
3612   }
3613 }
3614
3615 \NewDocumentCommand \__stex_variables_do_complex:nn { m m }{
3616   \clist_set:Nx \l__stex_variables_names { \tl_to_str:n {#1} }
3617   \exp_args:Nnx \use:nn {
3618     % TODO
3619     \stex_annotate_invisible:nnn {vardecl}{\clist_use:Nn\l__stex_variables_names,}{
3620       #2
3621     }
3622   }{
3623     \_stex_reset:N \varnot
3624     \_stex_reset:N \vartype
3625     \_stex_reset:N \vardefi
3626   }
3627 }
3628
3629 \NewDocumentCommand \vardef { s } {
3630   \IfBooleanTF#1 {
3631     \__stex_variables_do_complex:nn
3632   }{
3633     \__stex_variables_do_simple:nnn
3634   }
3635 }
3636
3637 \NewDocumentCommand \svar { 0{} m }{
3638   \tl_if_empty:nTF {#1}{
3639     \str_set:Nn \l_tmpa_str { #2 }
3640   }{
3641     \str_set:Nn \l_tmpa_str { #1 }
3642   }
3643   \_stex_term_omv:nn {
3644     var://\l_tmpa_str
3645   }{
3646     \exp_args:Nnx \use:nn {
3647       \def\comp{\_varcomp}
3648       \str_set:Nx \STEXInternalCurrentSymbolStr { var://\l_tmpa_str }
3649       \comp{ #2 }
3650     }{
3651       \_stex_reset:N \comp
3652       \_stex_reset:N \STEXInternalCurrentSymbolStr
3653     }
3654   }
3655 }
3656
3657
3658
3659 \keys_define:nn { stex / varseq } {

```

```

3660 name .str_set_x:N = \l__stex_variables_name_str ,
3661 args .int_set:N = \l__stex_variables_args_int ,
3662 type .tl_set:N = \l__stex_variables_type_tl ,
3663 mid .tl_set:N = \l__stex_variables_mid_tl ,
3664 bind .choices:nn =
3665     {forall,exists}
3666     {\str_set:Nx \l__stex_variables_bind_str {\l_keys_choice_tl}}
3667 }
3668
3669 \cs_new_protected:Nn \__stex_variables_seq_args:n {
3670     \str_clear:N \l__stex_variables_name_str
3671     \int_set:Nn \l__stex_variables_args_int 1
3672     \tl_clear:N \l__stex_variables_type_tl
3673     \str_clear:N \l__stex_variables_bind_str
3674
3675     \keys_set:nn { stex / varseq } { #1 }
3676 }
3677
3678 \NewDocumentCommand \varseq {m O{} m m m}{
3679     \__stex_variables_seq_args:n { #2 }
3680     \str_if_empty:NT \l__stex_variables_name_str {
3681         \str_set:Nx \l__stex_variables_name_str { #1 }
3682     }
3683     \prop_clear:N \l_tmpa_prop
3684     \prop_put:Nnx \l_tmpa_prop { arity }{\int_use:N \l__stex_variables_args_int}
3685
3686     \seq_set_from_clist:Nn \l_tmpa_seq {#3}
3687     \int_compare:nNnF {\seq_count:N \l_tmpa_seq} = \l__stex_variables_args_int {
3688         \msg_error:nnxx{stex}{error/seqlength}
3689         {\int_use:N \l__stex_variables_args_int}
3690         {\seq_count:N \l_tmpa_seq}
3691     }
3692     \seq_set_from_clist:Nn \l_tmpb_seq {#4}
3693     \int_compare:nNnF {\seq_count:N \l_tmpb_seq} = \l__stex_variables_args_int {
3694         \msg_error:nnxx{stex}{error/seqlength}
3695         {\int_use:N \l__stex_variables_args_int}
3696         {\seq_count:N \l_tmpb_seq}
3697     }
3698     \prop_put:Nnn \l_tmpa_prop {starts} {#3}
3699     \prop_put:Nnn \l_tmpa_prop {ends} {#4}
3700
3701     \cs_generate_from_arg_count:cNnn {stex_varseq\l__stex_variables_name_str_cs}
3702     \cs_set:Npn {\int_use:N \l__stex_variables_args_int} { #5 }
3703
3704     % argnames
3705
3706     \clist_clear:N \l_tmpa_clist
3707     \int_step_inline:nn {\l__stex_variables_args_int} {
3708         \clist_put_right:Nn \l_tmpa_clist {##1}
3709     }
3710     \prop_put:Nnx \l_tmpa_prop {argnames} {\clist_use:Nn \l_tmpa_clist ,}
3711
3712
3713

```

```

3714 \exp_args:NNo \tl_set:No \l_tmpa_tl {\use:c{stex_varseq_\l__stex_variables_name_str_cs}}
3715 \int_step_inline:nn \l__stex_variables_args_int {
3716   \tl_put_right:Nx \l_tmpa_tl { {\seq_item:Nn \l_tmpa_seq {##1}} }
3717 }
3718 \tl_set:Nx \l_tmpa_tl {\exp_args:NNo \exp_args:No \exp_not:n{\l_tmpa_tl}}
3719 \tl_put_right:Nn \l_tmpa_tl {,\ellipses,}
3720 \tl_if_empty:NF \l__stex_variables_mid_tl {
3721   \tl_put_right:No \l_tmpa_tl \l__stex_variables_mid_tl
3722   \tl_put_right:Nn \l_tmpa_tl {,\ellipses,}
3723 }
3724 \exp_args:NNo \tl_set:No \l_tmpb_tl {\use:c{stex_varseq_\l__stex_variables_name_str_cs}}
3725 \int_step_inline:nn \l__stex_variables_args_int {
3726   \tl_put_right:Nx \l_tmpb_tl { {\seq_item:Nn \l_tmpb_seq {##1}} }
3727 }
3728 \tl_set:Nx \l_tmpb_tl {\exp_args:NNo \exp_args:No \exp_not:n{\l_tmpb_tl}}
3729 \tl_put_right:No \l_tmpa_tl \l_tmpb_tl
3730
3731
3732
3733 \prop_put:Nno \l_tmpa_prop { notation }\l_tmpa_tl
3734
3735 \tl_set:cx {#1} {\stex_invoke_sequence:n {\l__stex_variables_name_str}}
3736
3737 \exp_args:NNo \tl_set:No \l_tmpa_tl {\use:c{stex_varseq_\l__stex_variables_name_str_cs}}
3738
3739 \int_step_inline:nn \l__stex_variables_args_int {
3740   \tl_set:Nx \l_tmpa_tl {\exp_args:No \exp_not:n \l_tmpa_tl {
3741     \STEXInternalTermMathArgiii{i##1}{0}{\exp_not:n{####}##1}
3742   }}
3743 }
3744
3745 \tl_set:Nx \l_tmpa_tl {
3746   \STEXInternalTermMathOMaiiii { varseq://\l__stex_variables_name_str}{0}{
3747     \exp_args:NNo \exp_args:No \exp_not:n {\l_tmpa_tl}
3748   }
3749 }
3750
3751 \tl_set:No \l_tmpa_tl { \exp_after:wN { \l_tmpa_tl \STEXInternalSymbolAfterInvokationTL} }
3752
3753 \exp_args:Nno \use:nn {
3754   \cs_generate_from_arg_count:cNnn {stex_varseq_\l__stex_variables_name_str_cs}
3755   \cs_set:Npn {\int_use:N \l__stex_variables_args_int}{\l_tmpa_tl}
3756
3757   \stex_debug:nn{sequences}{New~Sequence:~
3758     \expandafter\meaning\csname stex_varseq_\l__stex_variables_name_str_cs\endcsname\\~\\
3759   \prop_to_keyval:N \l_tmpa_prop
3760 }
3761 \prop_set_eq:cN {\l_stex_symdecl_varseq://\l__stex_variables_name_str_prop}\l_tmpa_prop
3762
3763 \stex_if_do_html:T{\stex_annotate_invisible:nnn{varseq}{\l__stex_variables_name_str}{
3764   \tl_if_empty:NF \l__stex_variables_type_tl {
3765     \stex_annotate:nnn {type}{\l__stex_variables_type_tl$}
3766   }
3767   \stex_annotate:nnn {args}{\int_use:N \l__stex_variables_args_int}{

```

```

3768 \str_if_empty:NF \l__stex_variables_bind_str {
3769   \stex_annotate:nnn {bindtype}{\l__stex_variables_bind_str}{}
3770 }
3771 \stex_annotate:nnn{startindex}{}{${#3$}
3772 \stex_annotate:nnn{endindex}{}{${#4$}
3773
3774 \tl_clear:N \l_tmpa_tl
3775 \int_step_inline:nn \l__stex_variables_args_int {
3776   \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3777     \stex_annotate:nnn{argmarker}{##1}{}
3778   } }
3779 }
3780 \stex_annotate_invisible:nnn { notationcomp }{}{
3781   \str_set:Nx \STEXInternalCurrentSymbolStr {varseq://\l__stex_variables_name_str }
3782   $ \exp_args:Nno \use:nn { \use:c {
3783     stex_varseq\l__stex_variables_name_str _cs
3784   } } { \l_tmpa_tl } $
3785 }
3786 \stex_annotate_invisible:nnn { notationopcomp }{}{
3787   $ \prop_item:Nn \l_tmpa_prop { notation } $
3788 }
3789
3790 }}
3791
3792 \ignorespacesandpars
3793 }
3794
3795
3796 \keys_define:nn { stex / mmtdecl } {
3797   name      .str_set_x:N = \l_stex_symdecl_name_str ,
3798   args      .str_set_x:N = \l_stex_symdecl_args_str ,
3799   deprecate .str_set_x:N = \l_stex_symdecl_deprecate_str ,
3800   reorder   .str_set_x:N = \l_stex_symdecl_reorder_str ,
3801   argnames  .clist_set:N = \l_stex_symdecl_argnames_clist ,
3802   assoc     .choices:nn =
3803     {bin,binl,binr,pre,conj,pwconj}
3804     {\str_set:Nx \l_stex_symdecl_assoc_type_str {\l_keys_choice_tl}}
3805 }
3806
3807 \cs_new_protected:Nn \_stex_mmtdecl_args:n {
3808   \str_clear:N \l_stex_symdecl_name_str
3809   \str_clear:N \l_stex_symdecl_args_str
3810   \str_clear:N \l_stex_symdecl_deprecate_str
3811   \str_clear:N \l_stex_symdecl_reorder_str
3812   \str_clear:N \l_stex_symdecl_assoc_type_str
3813   \bool_set_false:N \l_stex_symdecl_local_bool
3814   \clist_clear:N \l_stex_symdecl_argnames_clist
3815
3816   \keys_set:nn { stex / symdecl } { #1 }
3817 }
3818
3819 \NewDocumentCommand \mmtdecl { s m O{} } {
3820   \_stex_mmtdecl_args:n{#3}
3821   \IfBooleanTF #1 {

```

```

3822   \bool_set_false:N \l_stex_symdecl_make_macro_bool
3823 } {
3824   \bool_set_true:N \l_stex_symdecl_make_macro_bool
3825 }
3826 \str_if_empty:NT \l_stex_symdecl_name_str {
3827   \str_set:Nx \l_stex_symdecl_name_str { #1 }
3828 }
3829 %\tl_set:Nx \l_stex_symdecl_definiens_tl {
3830 %   \stex_annotate:nnn{ OMID }{
3831 %     \l_stex_module_mmtfor_str?\l_stex_symdecl_name_str
3832 %   }{}
3833 %}
3834 \stex_symdecl_do:n{#2}
3835 \MMTrule{rules.stex.mmt.kwarc.info?SubstitutionRule}{
3836   \stex_annotate:nnn{ OMID }{
3837     \l_stex_current_module_str ? \l_stex_symdecl_name_str
3838   }{},
3839   \stex_annotate:nnn{ OMID }{
3840     \l_stex_module_mmtfor_str?\l_stex_symdecl_name_str
3841   }{}
3842 }
3843 \stex_smsmode_do:
3844 }
3845
3846 \stex_deactivate_macro:Nn \mmtdecl {mmtinterface~environments}
3847 \stex_deactivate_macro:Nn \mmtdef {mmtinterface~environments}
3848
3849 </package>

```

Chapter 32

STEX -Terms Implementation

```
3850 <*package>
3851
3852 %%%%%%%%%%% terms.dtx %%%%%%%%%%%
3853
3854 <@@=stex_terms>
3855
3856   Warnings and error messages
3857   \msg_new:nnn{stex}{error/nonotation}{
3858     Symbol~#1~invoked,~but~has~no~notation#2!
3859   }
3860   \msg_new:nnn{stex}{error/notationarg}{
3861     Error~in~parsing~notation~#1
3862   }
3863   \msg_new:nnn{stex}{error/noop}{
3864     Symbol~#1~has~no~operator~notation~for~notation~#2
3865   }
3866   \msg_new:nnn{stex}{error/notallowed}{
3867     Symbol~invocation~#1~not~allowed~in~notation~component~of~#2
3868   }
3869   \msg_new:nnn{stex}{error/doubleargument}{
3870     Argument~#1~of~symbol~#2~already~assigned
3871   }
3872   \msg_new:nnn{stex}{error/overarity}{
3873     Argument~#1~invalid~for~symbol~#2~with~arity~#3
3874   }
```

32.1 Symbol Invocations

`\stex_invoke_symbol:n` Invokes a semantic macro

```
3874
3875
3876 \bool_new:N \l_stex_allow_semantic_bool
3877 \bool_set_true:N \l_stex_allow_semantic_bool
3878
```

```

3879 \cs_new_protected:Nn \stex_invoke_symbol:n {
3880   \ifvmode\indent\fi
3881   \bool_if:NTF \l_stex_allow_semantic_bool {
3882     \str_if_eq:eeF {
3883       \prop_item:cn {
3884         l_stex_symdecl_#1_prop
3885       }{ deprecate }
3886     }{}{
3887       \msg_warning:nxxx{stex}{warning/deprecated}{
3888         Symbol~#1
3889       }{
3890         \prop_item:cn {l_stex_symdecl_#1_prop}{ deprecate }
3891       }
3892     }
3893     \if_mode_math:
3894       \exp_after:wN \__stex_terms_invoke_math:n
3895     \else:
3896       \exp_after:wN \__stex_terms_invoke_text:n
3897     \fi: { #1 }
3898   }{
3899     \msg_error:nxxx{stex}{error/notallowed}{#1}{\STEXInternalCurrentSymbolStr}
3900   }
3901 }
3902
3903 \cs_new_protected:Nn \__stex_terms_invoke_text:n {
3904   \peek_charcode_remove:NTF ! {
3905     \__stex_terms_invoke_op_custom:nn {#1}
3906   }{
3907     \__stex_terms_invoke_custom:nn {#1}
3908   }
3909 }
3910
3911 \cs_new_protected:Nn \__stex_terms_invoke_math:n {
3912   \peek_charcode_remove:NTF ! {
3913     % operator
3914     \peek_charcode_remove:NTF * {
3915       % custom op
3916       \__stex_terms_invoke_op_custom:nn {#1}
3917     }{
3918       % op notation
3919       \peek_charcode:NTF [ {
3920         \__stex_terms_invoke_op_notation:nw {#1}
3921       }{
3922         \__stex_terms_invoke_op_notation:nw {#1}[]
3923       }
3924     }
3925   }{
3926     \peek_charcode_remove:NTF * {
3927       \__stex_terms_invoke_custom:nn {#1}
3928       % custom
3929     }{
3930       % normal
3931       \peek_charcode:NTF [ {
3932         \__stex_terms_invoke_notation:nw {#1}

```

```

3933     }{
3934       \__stex_terms_invoke_notation:nw {#1}[]
3935     }
3936   }
3937 }
3938 }
3939
3940
3941 \cs_new_protected:Nn \__stex_terms_invoke_op_custom:nn {
3942   \exp_args:Nnx \use:nn {
3943     \def\comp{\_comp}
3944     \str_set:Nn \STEXInternalCurrentSymbolStr { #1 }
3945     \bool_set_false:N \l_stex_allow_semantic_bool
3946     \stex_mathml_intent:nn{#1}{
3947       \stex_term_oms:nnn {#1}{#1 \c_hash_str CUSTOM-}{
3948         \comp{ #2 }
3949       }
3950     }
3951   }{
3952     \stex_reset:N \comp
3953     \stex_reset:N \STEXInternalCurrentSymbolStr
3954     \bool_set_true:N \l_stex_allow_semantic_bool
3955   }
3956 }
3957
3958 \keys_define:nn { stex / terms } {
3959   % lang      .tl_set_x:N = \l_stex_notation_lang_str ,
3960   variant .tl_set_x:N = \l_stex_notation_variant_str ,
3961   unknown .code:n      = \str_set:Nx
3962     \l_stex_notation_variant_str \l_keys_key_str
3963 }
3964
3965 \cs_new_protected:Nn \__stex_terms_args:n {
3966   % \str_clear:N \l_stex_notation_lang_str
3967   \str_clear:N \l_stex_notation_variant_str
3968
3969   \keys_set:nn { stex / terms } { #1 }
3970 }
3971
3972 \cs_new_protected:Nn \stex_find_notation:nn {
3973   \__stex_terms_args:n { #2 }
3974   \seq_if_empty:cTF {
3975     \l_stex_symdecl_ #1 _notations
3976   } {
3977     \msg_error:nnxx{stex}{error/nonotation}{#1}{s}
3978   } {
3979     \str_if_empty:NTF \l_stex_notation_variant_str {
3980       \seq_get_left:cN {\l_stex_symdecl_#1_notations}\l_stex_notation_variant_str
3981     }{
3982       \seq_if_in:cxTF {\l_stex_symdecl_#1_notations}{
3983         \l_stex_notation_variant_str
3984       }{
3985         % \str_set:Nx \l_stex_notation_variant_str { \l_stex_notation_variant_str \c_hash_str
3986       }{

```



```

3987         \msg_error:nxxx{stex}{error/nonotation}{#1}{
3988         ~\l_stex_notation_variant_str
3989         }
3990     }
3991 }
3992 }
3993 }
3994
3995 \cs_new_protected:Npn \__stex_terms_invoke_op_notation:nw #1 [#2] {
3996     \exp_args:Nnx \use:nn {
3997         \def\comp{\_comp}
3998         \str_set:Nn \STEXInternalCurrentSymbolStr { #1 }
3999         \stex_find_notation:nn { #1 }{ #2 }
4000         \bool_set_false:N \l_stex_allow_semantic_bool
4001         \cs_if_exist:cTF {
4002             stex_op_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs
4003         }{
4004             \_stex_term_oms:nnn { #1 }{
4005                 #1 \c_hash_str \l_stex_notation_variant_str
4006             }{
4007                 \use:c{stex_op_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs}
4008             }
4009         }{
4010             \int_compare:nNnTF {\prop_item:cn {l_stex_symdecl_#1_prop}{arity}} = 0{
4011                 \cs_if_exist:cTF {
4012                     stex_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs
4013                 }{
4014                     \tl_set:Nx \STEXInternalSymbolAfterInvocationTL {
4015                         \_stex_reset:N \comp
4016                         \_stex_reset:N \STEXInternalSymbolAfterInvocationTL
4017                         \_stex_reset:N \STEXInternalCurrentSymbolStr
4018                         \bool_set_true:N \l_stex_allow_semantic_bool
4019                     }
4020                     \def\comp{\_comp}
4021                     \str_set:Nn \STEXInternalCurrentSymbolStr { #1 }
4022                     \bool_set_false:N \l_stex_allow_semantic_bool
4023                     \use:c{stex_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs}
4024                 }{
4025                     \msg_error:nxxx{stex}{error/nonotation}{#1}{
4026                     ~\l_stex_notation_variant_str
4027                     }
4028                 }
4029             }{
4030                 \msg_error:nxxx{stex}{error/noop}{#1}{\l_stex_notation_variant_str}
4031             }
4032         }
4033     }{
4034         \_stex_reset:N \comp
4035         \_stex_reset:N \STEXInternalCurrentSymbolStr
4036         \bool_set_true:N \l_stex_allow_semantic_bool
4037     }
4038 }
4039
4040 \cs_new_protected:Npn \__stex_terms_invoke_notation:nw #1 [#2] {

```

```

4041 \stex_find_notation:nn { #1 }{ #2 }
4042 \cs_if_exist:cTF {
4043   stex_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs
4044 }{
4045   \tl_set:Nx \STEXInternalSymbolAfterInvokationTL {
4046     \_stex_reset:N \comp
4047     \_stex_reset:N \STEXInternalSymbolAfterInvokationTL
4048     \_stex_reset:N \STEXInternalCurrentSymbolStr
4049     \bool_set_true:N \l_stex_allow_semantic_bool
4050   }
4051   \def\comp{\_comp}
4052   \str_set:Nn \STEXInternalCurrentSymbolStr { #1 }
4053   \bool_set_false:N \l_stex_allow_semantic_bool
4054   \use:c{stex_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs}
4055 }{
4056   \msg_error:nnxx{stex}{error/nonotation}{#1}{
4057     ~\l_stex_notation_variant_str
4058   }
4059 }
4060 }
4061
4062 \prop_new:N \l__stex_terms_custom_args_prop
4063 \clist_new:N \l_stex_argnames_seq
4064 \seq_new:N \l__stex_terms_tmp_seq
4065
4066 \cs_new_protected:Nn \__stex_terms_custom_comp:n{ \bool_set_false:N \l_stex_allow_semantic_bo
4067
4068 \cs_new_protected:Nn \__stex_terms_invoke_custom:nn {
4069   \exp_args:Nnx \use:nn {
4070     \def\comp{\__stex_terms_custom_comp:n}
4071     \str_set:Nn \STEXInternalCurrentSymbolStr { #1 }
4072     \prop_clear:N \l__stex_terms_custom_args_prop
4073     \prop_put:Nnn \l__stex_terms_custom_args_prop {currnum} {1}
4074     \prop_get:cnN {
4075       l_stex_symdecl_#1 _prop
4076     }{ args } \l_tmpa_str
4077     \exp_args:NNx \seq_set_from_clist:Nn \l_stex_argnames_seq {
4078       \prop_item:cn {l_stex_symdecl_#1 _prop}{argnames}
4079     }
4080     \prop_put:Nno \l__stex_terms_custom_args_prop {args} \l_tmpa_str
4081     \tl_set:Nn \arg { \__stex_terms_arg: }
4082     \str_if_empty:NTF \l_tmpa_str {
4083       \stex_mathml_intent:nn{#1}{
4084         \_stex_term_oms:nnn {#1}{#1\c_hash_str CUSTOM-}{\ignorespaces#2}
4085       }
4086     }{
4087       \seq_clear:N \l__stex_terms_tmp_seq
4088       \exp_args:Nx\int_step_inline:nn{\prop_item:cn{l_stex_symdecl_#1 _prop}{arity}}{
4089         \tl_set:Nx \l__stex_terms_tmp_tl {\seq_item:Nn \l_stex_argnames_seq {##1}}
4090         \bool_lazy_or:nnT{
4091           \str_if_eq_p:nn{a}{\str_item:Nn \l_tmpa_str{##1}}
4092         }{
4093           \str_if_eq_p:nn{B}{\str_item:Nn \l_tmpa_str{##1}}
4094         }{

```

```

4095         \tl_put_right:Nn \l__stex_terms_tmp_tl +
4096     }
4097     \seq_put_right:No \l__stex_terms_tmp_seq \l__stex_terms_tmp_tl
4098 }
4099 \stex_mathml_intent:nn{
4100     #1[\prop_item:cn {l_stex_symdecl_#1 _prop}]{ args }(
4101         \seq_use:Nn \l__stex_terms_tmp_seq ,
4102     )
4103 }{
4104     \str_if_in:NnTF \l_tmpa_str b {
4105         \_stex_term_ombind:nnn {#1}{#1\c_hash_str CUSTOM-\l_tmpa_str}{\ignorespaces#2}
4106     }{
4107         \str_if_in:NnTF \l_tmpa_str B {
4108             \_stex_term_ombind:nnn {#1}{#1\c_hash_str CUSTOM-\l_tmpa_str}{\ignorespaces#2}
4109         }{
4110             \_stex_term_oma:nnn {#1}{#1\c_hash_str CUSTOM-\l_tmpa_str}{\ignorespaces#2}
4111         }
4112     }
4113 }
4114 }
4115 % TODO check that all arguments exist
4116 }{
4117     \_stex_reset:N \l_stex_argnames_seq
4118     \_stex_reset:N \STEXInternalCurrentSymbolStr
4119     \_stex_reset:N \arg
4120     \_stex_reset:N \comp
4121     \_stex_reset:N \l__stex_terms_custom_args_prop
4122     %\bool_set_true:N \l_stex_allow_semantic_bool
4123 }
4124 }
4125
4126 \NewDocumentCommand \__stex_terms_arg: { s O{} m}{
4127     \tl_if_empty:nTF {#2}{
4128         \int_set:Nn \l_tmpa_int {\prop_item:Nn \l__stex_terms_custom_args_prop {currnum}}
4129         \bool_set_true:N \l_tmpa_bool
4130         \bool_do_while:Nn \l_tmpa_bool {
4131             \exp_args:NNx \prop_if_in:NnTF \l__stex_terms_custom_args_prop {\int_use:N \l_tmpa_int}
4132             \int_incr:N \l_tmpa_int
4133         }{
4134             \bool_set_false:N \l_tmpa_bool
4135         }
4136     }
4137     }{
4138         \int_set:Nn \l_tmpa_int { #2 }
4139     }
4140     \str_set:Nx \l_tmpa_str {\prop_item:Nn \l__stex_terms_custom_args_prop {args} }
4141     \int_compare:nNnT \l_tmpa_int > {\str_count:N \l_tmpa_str} {
4142         \msg_error:nnxxx{stex}{error/overarity}
4143         {\int_use:N \l_tmpa_int}
4144         {\STEXInternalCurrentSymbolStr}
4145         {\str_count:N \l_tmpa_str}
4146     }
4147     \str_set:Nx \l_tmpa_str {\str_item:Nn \l_tmpa_str \l_tmpa_int}
4148     \exp_args:NNx \prop_if_in:NnT \l__stex_terms_custom_args_prop {\int_use:N \l_tmpa_int} {

```

```

4149 \bool_lazy_any:nF {
4150   {\str_if_eq_p:Vn \l_tmpa_str {a}}
4151   {\str_if_eq_p:Vn \l_tmpa_str {B}}
4152 }{
4153   \msg_error:nnxx{stex}{error/doubleargument}
4154   {\int_use:N \l_tmpa_int}
4155   {\STEXInternalCurrentSymbolStr}
4156 }
4157 }
4158 \exp_args:NNx \prop_put:Nnn \l__stex_terms_custom_args_prop {\int_use:N \l_tmpa_int} {\ign
4159 \bool_if:NTF \l_stex_allow_semantic_bool \use_i:nn {
4160   \bool_set_true:N \l_stex_allow_semantic_bool
4161   \use:nn
4162 }
4163 {
4164   \stex_mathml_arg:nn{\seq_item:Nn \l_stex_argnames_seq \l_tmpa_int}{
4165     \IfBooleanTF#1{
4166       \stex_annotate_invisible:n { %TODO
4167         \exp_args:No \_stex_term_arg:nn {\l_tmpa_str\int_use:N \l_tmpa_int}{\ignorespaces#3}
4168       }
4169     }{ %TODO
4170       \exp_args:No \_stex_term_arg:nn {\l_tmpa_str\int_use:N \l_tmpa_int}{\ignorespaces#3}
4171     }
4172   }}
4173   {\bool_set_false:N \l_stex_allow_semantic_bool}
4174 }
4175
4176
4177 \cs_new_protected:Nn \_stex_term_arg:nn {
4178   \bool_set_true:N \l_stex_allow_semantic_bool
4179   \stex_annotate:nnn{ arg }{ #1 }{ #2 }
4180   \bool_set_false:N \l_stex_allow_semantic_bool
4181 }
4182
4183 \cs_new_protected:Npn \STEXInternalTermMathArgiii #1#2#3 {
4184   \exp_args:Nnx \use:nn
4185   { \int_set:Nn \l__stex_terms_downprec { #2 }
4186     \stex_mathml_arg:nn{\seq_item:Nn \l_stex_argnames_seq \l_tmpa_int}{
4187       \_stex_term_arg:nn { #1 }{ #3 }
4188     }
4189   }
4190   { \int_set:Nn \exp_not:N \l__stex_terms_downprec { \int_use:N \l__stex_terms_downprec }
4191 }

```

(End definition for `\stex_invoke_symbol:n`. This function is documented on page 92.)

`\STEXInternalTermMathAssocArgiiii`

```

4192 \cs_new_protected:Npn \STEXInternalTermMathAssocArgiiii #1#2#3#4#5 {
4193   \cs_set:Npn \l_tmpa_cs ##1 ##2 { #4 }
4194   \tl_set:Nn \l_tmpb_tl {\STEXInternalTermMathArgiii{#5#1}{#2}}
4195   \tl_if_empty:nTF { #3 }{
4196     \STEXInternalTermMathArgiii{#5#1}{#2}{}
4197   }{
4198     \exp_args:Nx \tl_if_empty:nTF { \tl_tail:n{ #3 } }{

```

```

4199     \expandafter\if\expandafter\relax\noexpand#3
4200     \tl_set:Nn \l_tmpa_tl {\__stex_terms_math_assoc_arg_maybe_sequence:Nnn#3{#1}{#5}}
4201     \else
4202     \tl_set:Nn \l_tmpa_tl {\__stex_terms_math_assoc_arg_simple:nnn{#1}{#3}{#5}}
4203     \fi
4204     \l_tmpa_tl
4205   }{
4206     \__stex_terms_math_assoc_arg_simple:nnn{#1}{#3}{#5}
4207   }
4208 }
4209 }
4210
4211 \cs_new_protected:Nn \__stex_terms_math_assoc_arg_maybe_sequence:Nnn {
4212   \str_set:Nx \l_tmpa_str { \cs_argument_spec:N #1 }
4213   \str_if_empty:NTF \l_tmpa_str {
4214     \exp_args:Nx \cs_if_eq:NNTF {
4215       \tl_head:N #1
4216     } \stex_invoke_sequence:n {
4217       \tl_set:Nx \l_tmpa_tl {\tl_tail:N #1}
4218       \str_set:Nx \l_tmpa_str {\exp_after:wN \use:n \l_tmpa_tl}
4219       \tl_set:Nx \l_tmpa_tl {\prop_item:cn {l_stex_symdecl_varseq://\l_tmpa_str _prop}{notat
4220       \exp_args:NNo \seq_set_from_clist:Nn \l_tmpa_seq \l_tmpa_tl
4221       \tl_set:Nx \l_tmpa_tl {\exp_not:N \exp_not:n{
4222         \exp_not:n{\exp_args:Nnx \use:nn} {
4223           \exp_not:n {
4224             \def\comp{\_varcomp}
4225             \str_set:Nn \STEXInternalCurrentSymbolStr
4226             } {varseq://\l_tmpa_str}
4227             \exp_not:n{ ##1 }
4228           }{
4229             \exp_not:n {
4230               \_stex_reset:N \comp
4231               \_stex_reset:N \STEXInternalCurrentSymbolStr
4232             }
4233           }
4234         }}}
4235       \exp_args:Nno \use:n {\seq_set_map:NNn \l_tmpa_seq \l_tmpa_seq} \l_tmpa_tl
4236       \seq_reverse:N \l_tmpa_seq
4237       \seq_pop:NN \l_tmpa_seq \l_tmpa_tl
4238       \seq_map_inline:Nn \l_tmpa_seq {
4239         \exp_args:NNNo \exp_args:NNo \tl_set:No \l_tmpa_tl {
4240           \exp_args:Nno
4241           \l_tmpa_cs { ##1 } \l_tmpa_tl
4242         }
4243       }
4244       \tl_set:Nx \l_tmpa_tl {
4245         \_stex_term_omv:nn {varseq://\l_tmpa_str}{
4246           \exp_args:No \exp_not:n \l_tmpa_tl
4247         }
4248       }
4249       \exp_args:No\l_tmpb_tl\l_tmpa_tl
4250     }{
4251       \__stex_terms_math_assoc_arg_simple:nnn{#2} { #1 }{#3}
4252     }

```

```

4253 } {
4254   \_stex_terms_math_assoc_arg_simple:nnn{#2} { #1 }{#3}
4255 }
4256
4257 }
4258
4259 \cs_new_protected:Nn \_stex_terms_math_assoc_arg_simple:nnn {
4260   \clist_set:Nn \l_tmpa_clist{ #2 }
4261   \int_compare:nNnTF { \clist_count:N \l_tmpa_clist } < 2 {
4262     \tl_set:Nn \l_tmpa_tl {
4263       \stex_mathml_arg:nn{\seq_item:Nn \l_stex_argnames_seq #1}{
4264         \_stex_term_arg:nn{A#3#1}{ #2 } }
4265     }
4266   }{
4267     \clist_reverse:N \l_tmpa_clist
4268     \clist_pop:NN \l_tmpa_clist \l_tmpa_tl
4269     \tl_set:Nx \l_tmpa_tl {
4270       \stex_mathml_arg:nn{\seq_item:Nn \l_stex_argnames_seq #1}{
4271         \_stex_term_arg:nn{A#3#1}{
4272           \exp_args:No \exp_not:n \l_tmpa_tl
4273         }
4274       }
4275     }
4276     \clist_map_inline:Nn \l_tmpa_clist {
4277       \exp_args:NNNo \exp_args:NNo \tl_set:No \l_tmpa_tl {
4278         \l_tmpa_cs {
4279           \stex_mathml_arg:nn{\seq_item:Nn \l_stex_argnames_seq #1}{
4280             \_stex_term_arg:nn{A#3#1}{##1}
4281           }
4282         } \l_tmpa_tl
4283       }
4284     }
4285   }
4286   \exp_args:No\l_tmpb_tl\l_tmpa_tl
4287 }

```

(End definition for `\STEXInternalTermMathAssocArgiiii`. This function is documented on page 93.)

32.2 Terms

Precedences:

```

\infprec
\neginfprec
\l__stex_terms_downprec
4288 \tl_const:Nx \infprec {\int_use:N \c_max_int}
4289 \tl_const:Nx \neginfprec {-\int_use:N \c_max_int}
4290 \int_new:N \l__stex_terms_downprec
4291 \int_set_eq:NN \l__stex_terms_downprec \infprec

```

(End definition for `\infprec`, `\neginfprec`, and `\l__stex_terms_downprec`. These variables are documented on page 93.)

Bracketing:

```

\l__stex_terms_left_bracket_str
\l__stex_terms_right_bracket_str
4292 \tl_set:Nn \l__stex_terms_left_bracket_str (
4293 \tl_set:Nn \l__stex_terms_right_bracket_str )

```

(End definition for `\l__stex_terms_left_bracket_str` and `\l__stex_terms_right_bracket_str`.)

`__stex_terms_maybe_brackets:nn` Compares precedences and insert brackets accordingly

```

4294 \cs_new_protected:Nn \__stex_terms_maybe_brackets:nn {
4295   \bool_if:NTF \l__stex_terms_brackets_done_bool {
4296     \bool_set_false:N \l__stex_terms_brackets_done_bool
4297     #2
4298   } {
4299     \int_compare:nNnTF { #1 } > \l__stex_terms_downprec {
4300       \bool_if:NTF \l__stex_inarray_bool { #2 } {
4301         \stex_debug:nn{dobrackets}{\number#1 > \number\l__stex_terms_downprec; \detokenize{#
4302         \dobrackets { #2 }
4303       }
4304     }{ #2 }
4305   }
4306 }
```

(End definition for `__stex_terms_maybe_brackets:nn`.)

`\dobrackets`

```

4307 \bool_new:N \l__stex_terms_brackets_done_bool
4308 %\RequirePackage{scalerel}
4309 \cs_new_protected:Npn \dobrackets #1 {
4310   %\ThisStyle{\if D\m@switch
4311   %   \exp_args:Nnx \use:nn
4312   %   { \exp_after:wN \left\l__stex_terms_left_bracket_str #1 }
4313   %   { \exp_not:N\right\l__stex_terms_right_bracket_str }
4314   %   \else
4315   %     \exp_args:Nnx \use:nn
4316   %     {
4317   %       \bool_set_true:N \l__stex_terms_brackets_done_bool
4318   %       \int_set:Nn \l__stex_terms_downprec \infprec
4319   %       \l__stex_terms_left_bracket_str
4320   %       #1
4321   %     }
4322   %     {
4323   %       \bool_set_false:N \l__stex_terms_brackets_done_bool
4324   %       \l__stex_terms_right_bracket_str
4325   %       \int_set:Nn \l__stex_terms_downprec { \int_use:N \l__stex_terms_downprec }
4326   %     }
4327   %\fi}
4328 }
```

(End definition for `\dobrackets`. This function is documented on page 93.)

`\withbrackets`

```

4329 \cs_new_protected:Npn \withbrackets #1 #2 #3 {
4330   \exp_args:Nnx \use:nn
4331   {
4332     \tl_set:Nx \l__stex_terms_left_bracket_str { #1 }
4333     \tl_set:Nx \l__stex_terms_right_bracket_str { #2 }
4334     #3
4335   }
4336 }
```

```

4337 \tl_set:Nn \exp_not:N \l__stex_terms_left_bracket_str
4338 {\l__stex_terms_left_bracket_str}
4339 \tl_set:Nn \exp_not:N \l__stex_terms_right_bracket_str
4340 {\l__stex_terms_right_bracket_str}
4341 }
4342 }

```

(End definition for `\withbrackets`. This function is documented on page 93.)

`\STEXinvisible`

```

4343 \cs_new_protected:Npn \STEXinvisible #1 {
4344 \stex_annotate_invisible:n { #1 }
4345 }

```

(End definition for `\STEXinvisible`. This function is documented on page 93.)

OMDoc terms:

`\STEXInternalTermMathOMSiiii`

```

4346 \cs_new_protected:Nn \_stex_term_oms:nnn {
4347 \stex_annotate:nnn{ OMID }{ #2 }{
4348 #3
4349 }
4350 }
4351
4352 \cs_new_protected:Npn \STEXInternalTermMathOMSiiii #1#2#3#4 {
4353 \__stex_terms_maybe_brackets:nn { #3 }{
4354 \stex_mathml_intent:nn{#1} {
4355 \_stex_term_oms:nnn { #1 } { #1\c_hash_str#2 } { #4 }
4356 }
4357 }
4358 }

```

(End definition for `\STEXInternalTermMathOMSiiii`. This function is documented on page 92.)

`_stex_term_math_omv:nn`

```

4359 \cs_new_protected:Nn \_stex_term_omv:nn {
4360 \stex_annotate:nnn{ OMV }{ #1 }{
4361 #2
4362 }
4363 }

```

(End definition for `_stex_term_math_omv:nn`. This function is documented on page ??.)

`\STEXInternalTermMathOMAiiai`

```

4364 \cs_new_protected:Nn \_stex_term_oma:nnn {
4365 \stex_annotate:nnn{ OMA }{ #2 }{
4366 #3
4367 }
4368 }
4369
4370 \cs_new_protected:Npn \STEXInternalTermMathOMAiiai #1#2#3#4 {
4371 \exp_args:Nnx \use:nn {
4372 \seq_clear:N \l__stex_terms_tmp_seq
4373 \prop_if_exist:cT{l_stex_symdecl_#1 _prop}{
4374 \exp_args:NNx \seq_set_from_clist:Nn \l_stex_argnames_seq {

```



```

4375     \prop_item:cn {l_stex_symdecl_#1 _prop}{argnames}
4376   }
4377   \exp_args:Nx\int_step_inline:nn{\prop_item:cn{l_stex_symdecl_#1 _prop}{arity}}{
4378     \tl_set:Nx \l__stex_terms_tmp_tl {\seq_item:Nn \l_stex_argnames_seq {##1}}
4379     \bool_lazy_or:nnT{
4380       \str_if_eq_p:nn{a}{\str_item:Nn\l_tmpa_str{##1}}
4381     }{
4382       \str_if_eq_p:nn{B}{\str_item:Nn\l_tmpa_str{##1}}
4383     }{
4384       \tl_put_right:Nn \l__stex_terms_tmp_tl +
4385     }
4386     \seq_put_right:No \l__stex_terms_tmp_seq \l__stex_terms_tmp_tl
4387   }
4388 }
4389 \__stex_terms_maybe_brackets:nn { #3 }{
4390   \stex_mathml_intent:nn{
4391     #1[\prop_item:cn {l_stex_symdecl_#1 _prop}{ args }](
4392       \seq_use:Nn \l__stex_terms_tmp_seq ,
4393     )
4394   }{
4395     \_stex_term_oma:nnn { #1 } { #1\c_hash_str#2 } { #4 }
4396   }
4397 }
4398 }{
4399   \_stex_reset:N \l_stex_argnames_seq
4400 }
4401 }

```

(End definition for `\STEXInternalTermMathOMAi`. This function is documented on page 92.)

`\STEXInternalTermMathOMBiiii`

```

4402 \cs_new_protected:Nn \_stex_term_ombind:nnn {
4403   \stex_annotate:nnn{ OMBIND }{ #2 }{
4404     #3
4405   }
4406 }
4407
4408 \cs_new_protected:Npn \STEXInternalTermMathOMBiiii #1#2#3#4 {
4409   \exp_args:Nnx \use:nn {
4410     \seq_clear:N \l__stex_terms_tmp_seq
4411     \prop_if_exist:cT{l_stex_symdecl_#1 _prop}{
4412       \exp_args:NNx \seq_set_from_clist:Nn \l_stex_argnames_seq {
4413         \prop_item:cn {l_stex_symdecl_#1 _prop}{argnames}
4414       }
4415       \exp_args:Nx\int_step_inline:nn{\prop_item:cn{l_stex_symdecl_#1 _prop}{arity}}{
4416         \tl_set:Nx \l__stex_terms_tmp_tl {\seq_item:Nn \l_stex_argnames_seq {##1}}
4417         \bool_lazy_or:nnT{
4418           \str_if_eq_p:nn{a}{\str_item:Nn\l_tmpa_str{##1}}
4419         }{
4420           \str_if_eq_p:nn{B}{\str_item:Nn\l_tmpa_str{##1}}
4421         }{
4422           \tl_put_right:Nn \l__stex_terms_tmp_tl +
4423         }
4424         \seq_put_right:No \l__stex_terms_tmp_seq \l__stex_terms_tmp_tl

```

```

4425     }
4426   }
4427   \__stex_terms_maybe_brackets:nn { #3 }{
4428     \stex_mathml_intent:nn{
4429       #1[\prop_item:cn {l_stex_symdecl_#1 _prop}{ args }](
4430         \seq_use:Nn \l__stex_terms_tmp_seq ,
4431       )
4432     }{
4433       \stex_term_ombind:nnn { #1 } { #1\c_hash_str#2 } { #4 }
4434     }
4435   }
4436   }{
4437     \stex_reset:N \l_stex_argnames_seq
4438   }
4439 }

```

(End definition for `\STEXInternalTermMathOMBiiii`. This function is documented on page 92.)

`\symref`
`\symname`

```

4440 \cs_new:Nn \stex_capitalize:n { \uppercase{#1} }
4441
4442 \keys_define:nn { stex / symname } {
4443   pre      .tl_set_x:N      = \l__stex_terms_pre_tl ,
4444   post     .tl_set_x:N      = \l__stex_terms_post_tl ,
4445   root     .tl_set_x:N      = \l__stex_terms_root_tl
4446 }
4447
4448 \cs_new_protected:Nn \stex_symname_args:n {
4449   \tl_clear:N \l__stex_terms_post_tl
4450   \tl_clear:N \l__stex_terms_pre_tl
4451   \tl_clear:N \l__stex_terms_root_str
4452   \keys_set:nn { stex / symname } { #1 }
4453 }
4454
4455 \NewDocumentCommand \symref { m m }{
4456   \let\compemph_uri_prev:\compemph@uri
4457   \let\compemph@uri\symrefemph@uri
4458   \STEXsymbol{#1}!\{ #2 }
4459   \let\compemph@uri\compemph_uri_prev:
4460 }
4461
4462 \NewDocumentCommand \synonym { 0{} m m }{
4463   \stex_symname_args:n { #1 }
4464   \let\compemph_uri_prev:\compemph@uri
4465   \let\compemph@uri\symrefemph@uri
4466   % TODO
4467   \STEXsymbol{#2}!\{\l__stex_terms_pre_tl #3 \l__stex_terms_post_tl}
4468   \let\compemph@uri\compemph_uri_prev:
4469 }
4470
4471 \NewDocumentCommand \symname { 0{} m }{
4472   \stex_symname_args:n { #1 }
4473   \stex_get_symbol:n { #2 }
4474   \str_set:Nx \l_tmpa_str {

```

```

4475 \prop_item:cn { l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop } { name }
4476 }
4477 \exp_args:NNno \str_replace_all:Nnn \l_tmpa_str {-} {~}
4478
4479 \let\compemph_uri_prev:\compemph@uri
4480 \let\compemph@uri\symrefemph@uri
4481 \exp_args:NNx \use:nn
4482 \stex_invoke_symbol:n { { \l_stex_get_symbol_uri_str }!\ifmode*\fi{
4483 \l__stex_terms_pre_tl \l_tmpa_str \l__stex_terms_post_tl
4484 } }
4485 \let\compemph@uri\compemph_uri_prev:
4486 }
4487
4488 \NewDocumentCommand \Symname { 0{} m }{
4489 \stex_symname_args:n { #1 }
4490 \stex_get_symbol:n { #2 }
4491 \str_set:Nx \l_tmpa_str {
4492 \prop_item:cn { l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop } { name }
4493 }
4494 \exp_args:NNno \str_replace_all:Nnn \l_tmpa_str {-} {~}
4495 \let\compemph_uri_prev:\compemph@uri
4496 \let\compemph@uri\symrefemph@uri
4497 \exp_args:NNx \use:nn
4498 \stex_invoke_symbol:n { { \l_stex_get_symbol_uri_str }!\ifmode*\fi{
4499 \exp_after:wN \stex_capitalize:n \l_tmpa_str
4500 \l__stex_terms_post_tl
4501 } }
4502 \let\compemph@uri\compemph_uri_prev:
4503 }

```

(End definition for `\symref` and `\symname`. These functions are documented on page 92.)

32.3 Notation Components

```

4504 <@@=stex_notationcomps>
\comp
\compemph@uri
\compemph
\defemph
\defemph@uri
\symrefemph
\symrefemph@uri
\varemp
\varemp@uri
4505 \cs_new_protected:Npn \_comp #1 {
4506 \str_if_empty:NF \STEXInternalCurrentSymbolStr {
4507 \stex_html_backend:TF {
4508 \stex_annotate:nnn { comp }{ \STEXInternalCurrentSymbolStr }{ #1 }
4509 }{
4510 \exp_args:Nnx \compemph@uri { #1 } { \STEXInternalCurrentSymbolStr }
4511 }
4512 }
4513 }
4514
4515 \cs_new_protected:Npn \_varcomp #1 {
4516 \str_if_empty:NF \STEXInternalCurrentSymbolStr {
4517 \stex_html_backend:TF {
4518 \stex_annotate:nnn { varcomp }{ \STEXInternalCurrentSymbolStr }{ #1 }
4519 }{
4520 \exp_args:Nnx \varemp@uri { #1 } { \STEXInternalCurrentSymbolStr }
4521 }

```

```

4522 }
4523 }
4524
4525 \def\comp{\_comp}
4526
4527 \cs_new_protected:Npn \compemph@uri #1 #2 {
4528   \compemph{ #1 }
4529 }
4530
4531
4532 \cs_new_protected:Npn \compemph #1 {
4533   #1
4534 }
4535
4536 \cs_new_protected:Npn \defemph@uri #1 #2 {
4537   \defemph{#1}
4538 }
4539
4540 \cs_new_protected:Npn \defemph #1 {
4541   \textbf{#1}
4542 }
4543
4544 \cs_new_protected:Npn \symrefemph@uri #1 #2 {
4545   \symrefemph{#1}
4546 }
4547
4548 \cs_new_protected:Npn \symrefemph #1 {
4549   \emph{#1}
4550 }
4551
4552 \cs_new_protected:Npn \varemp@uri #1 #2 {
4553   \varemp{#1}
4554 }
4555
4556 \cs_new_protected:Npn \varemp #1 {
4557   #1
4558 }

```

(End definition for `\comp` and others. These functions are documented on page 93.)

`\ellipses`

```

4559 \NewDocumentCommand \ellipses {} { \ldots }

```

(End definition for `\ellipses`. This function is documented on page 93.)

```

\parray
\prmatrix 4560 \bool_new:N \l_stex_inparray_bool
\parrayline 4561 \bool_set_false:N \l_stex_inparray_bool
\parraylineh 4562 \NewDocumentCommand \parray { m m } {
\parraycell 4563   \begingroup
4564   \bool_set_true:N \l_stex_inparray_bool
4565   \begin{array}{#1}
4566     #2
4567   \end{array}
4568   \endgroup

```

```

4569 }
4570
4571 \NewDocumentCommand \prmatrix { m } {
4572   \begingroup
4573   \bool_set_true:N \l_stex_inarray_bool
4574   \begin{matrix}
4575     #1
4576   \end{matrix}
4577   \endgroup
4578 }
4579
4580 \def \maybepline {
4581   \bool_if:NT \l_stex_inarray_bool {\hline}
4582 }
4583
4584 \def \parrayline #1 #2 {
4585   #1 #2 \bool_if:NT \l_stex_inarray_bool {\}
4586 }
4587
4588 \def \pmrow #1 { \parrayline{}{ #1 } }
4589
4590 \def \parraylineh #1 #2 {
4591   #1 #2 \bool_if:NT \l_stex_inarray_bool {\hline}
4592 }
4593
4594 \def \parraycell #1 {
4595   #1 \bool_if:NT \l_stex_inarray_bool {&}
4596 }

```

(End definition for \parray and others. These functions are documented on page ??.)

32.4 Variables

```

4597 <@@=stex_variables>

```

\stex_invoke_variable:n Invokes a variable

```

4598 \cs_new_protected:Nn \stex_invoke_variable:n {
4599   \if_mode_math:
4600     \exp_after:wN \__stex_variables_invoke_math:n
4601   \else:
4602     \exp_after:wN \__stex_variables_invoke_text:n
4603   \fi: {#1}
4604 }
4605
4606 \cs_new_protected:Nn \__stex_variables_invoke_text:n {
4607   \peek_charcode_remove:NTF ! {
4608     \__stex_variables_invoke_op_custom:nn {#1}
4609   }{
4610     \__stex_variables_invoke_custom:nn {#1}
4611   }
4612 }
4613
4614
4615 \cs_new_protected:Nn \__stex_variables_invoke_math:n {

```

```

4616 \peek_charcode_remove:NTF ! {
4617   \peek_charcode_remove:NTF ! {
4618     \peek_charcode:NTF [ {
4619       % TODO throw error
4620     }{
4621       \__stex_variables_invoke_op_custom:nn
4622     }
4623   }{
4624     \__stex_variables_invoke_op:n { #1 }
4625   }
4626 }{
4627   \peek_charcode_remove:NTF * {
4628     \__stex_variables_invoke_custom:nn { #1 }
4629   }{
4630     \__stex_variables_invoke_math_ii:n { #1 }
4631   }
4632 }
4633 }
4634
4635 \cs_new_protected:Nn \__stex_variables_invoke_op_custom:nn {
4636   \exp_args:Nnx \use:nn {
4637     \def\comp{\_varcomp}
4638     \str_set:Nn \STEXInternalCurrentSymbolStr { var://#1 }
4639     \bool_set_false:N \l_stex_allow_semantic_bool
4640     \stex_term_omv:nn {var://#1}{
4641       \comp{ #2 }
4642     }
4643   }{
4644     \stex_reset:N \comp
4645     \stex_reset:N \STEXInternalCurrentSymbolStr
4646     \bool_set_true:N \l_stex_allow_semantic_bool
4647   }
4648 }
4649
4650 \cs_new_protected:Nn \__stex_variables_invoke_op:n {
4651   \cs_if_exist:cTF {
4652     stex_var_op_notation_ #1 _cs
4653   }{
4654     \exp_args:Nnx \use:nn {
4655       \def\comp{\_varcomp}
4656       \str_set:Nn \STEXInternalCurrentSymbolStr { var://#1 }
4657       \stex_term_omv:nn { var://#1 }{
4658         \use:c{stex_var_op_notation_ #1 _cs }
4659       }
4660     }{
4661       \stex_reset:N \comp
4662       \stex_reset:N \STEXInternalCurrentSymbolStr
4663     }
4664   }{
4665     \int_compare:nNnTF {\prop_item:cn {l_stex_symdecl_var://#1_prop}{arity}} = 0{
4666       \__stex_variables_invoke_math_ii:n {#1}
4667     }{
4668       \msg_error:nxxx{stex}{error/noop}{variable~#1}{}
4669     }

```

```

4670 }
4671 }
4672
4673 \cs_new_protected:Npn \__stex_variables_invoke_math_ii:n #1 {
4674   \cs_if_exist:cTF {
4675     stex_var_notation_#1_cs
4676   }{
4677     \tl_set:Nx \STEXInternalSymbolAfterInvokationTL {
4678       \_stex_reset:N \comp
4679       \_stex_reset:N \STEXInternalSymbolAfterInvokationTL
4680       \_stex_reset:N \STEXInternalCurrentSymbolStr
4681       \bool_set_true:N \l_stex_allow_semantic_bool
4682     }
4683     \def\comp{\_varcomp}
4684     \str_set:Nn \STEXInternalCurrentSymbolStr { var://#1 }
4685     \bool_set_false:N \l_stex_allow_semantic_bool
4686     \use:c{stex_var_notation_#1_cs}
4687   }{
4688     \msg_error:nnxx{stex}{error/nonotation}{variable-#1}{s}
4689   }
4690 }
4691
4692 \cs_new_protected:Nn \__stex_variables_invoke_custom:nn {
4693   \exp_args:Nnx \use:nn {
4694     \def\comp{\_varcomp}
4695     \str_set:Nn \STEXInternalCurrentSymbolStr { var://#1 }
4696     \prop_clear:N \l__stex_terms_custom_args_prop
4697     \prop_put:Nnn \l__stex_terms_custom_args_prop {currnum} {1}
4698     \prop_get:cnN {
4699       l_stex_symdecl_var://#1 _prop
4700     }{ args } \l_tmpa_str
4701     \prop_put:Nno \l__stex_terms_custom_args_prop {args} \l_tmpa_str
4702     \tl_set:Nn \arg { \_stex_terms_arg: }
4703     \str_if_empty:NTF \l_tmpa_str {
4704       \_stex_term_omv:nn {var://#1}{\ignorespaces#2}
4705     }{
4706       \str_if_in:NnTF \l_tmpa_str b {
4707         \_stex_term_ombind:nnn {var://#1}{\ignorespaces#2}
4708       }{
4709         \str_if_in:NnTF \l_tmpa_str B {
4710           \_stex_term_ombind:nnn {var://#1}{\ignorespaces#2}
4711         }{
4712           \_stex_term_oma:nnn {var://#1}{\ignorespaces#2}
4713         }
4714       }
4715     }
4716     % TODO check that all arguments exist
4717   }{
4718     \_stex_reset:N \STEXInternalCurrentSymbolStr
4719     \_stex_reset:N \arg
4720     \_stex_reset:N \comp
4721     \_stex_reset:N \l__stex_terms_custom_args_prop
4722     %\bool_set_true:N \l_stex_allow_semantic_bool
4723   }

```

```
4724 }
```

(End definition for `\stex_invoke_variable:n`. This function is documented on page ??.)

32.5 Sequences

```
4725 <@@=stex_sequences>
4726
4727 \cs_new_protected:Nn \stex_invoke_sequence:n {
4728   \peek_charcode_remove:NTF ! {
4729     \stex_term_omv:nn {varseq://#1}{
4730       \exp_args:Nnx \use:nn {
4731         \def\comp{\_varcomp}
4732         \str_set:Nn \STEXInternalCurrentSymbolStr {varseq://#1}
4733         \prop_item:cn{l_stex_symdecl_varseq://#1_prop}{notation}
4734       }{
4735         \_stex_reset:N \comp
4736         \_stex_reset:N \STEXInternalCurrentSymbolStr
4737       }
4738     }
4739   }{
4740     \bool_set_false:N \l_stex_allow_semantic_bool
4741     \def\comp{\_varcomp}
4742     \str_set:Nn \STEXInternalCurrentSymbolStr {varseq://#1}
4743     \tl_set:Nx \STEXInternalSymbolAfterInvokationTL {
4744       \_stex_reset:N \comp
4745       \_stex_reset:N \STEXInternalSymbolAfterInvokationTL
4746       \_stex_reset:N \STEXInternalCurrentSymbolStr
4747       \bool_set_true:N \l_stex_allow_semantic_bool
4748     }
4749     \use:c { stex_varseq_#1_cs }
4750   }
4751 }
4752 </package>
```


Chapter 33

STEX -Structural Features Implementation

```
4753 ⟨*package⟩
4754
4755 %%%%%%%%%%% features.dtx %%%%%%%%%%%
4756
      Warnings and error messages
4757 \msg_new:nnn{stex}{error/copymodule/notallowed}{
4758   Symbol~#1~can~not~be~assigned~in~copymodule~#2
4759 }
4760 \msg_new:nnn{stex}{error/interpretmodule/nodfiniens}{
4761   Symbol~#1~not~assigned~in~interpretmodule~#2
4762 }
4763
4764 \msg_new:nnn{stex}{error/unknownstructure}{
4765   No~structure~#1~found!
4766 }
4767
4768 \msg_new:nnn{stex}{error/unknownfield}{
4769   No~field~#1~in~instance~#2~found!\#3
4770 }
4771
4772 \msg_new:nnn{stex}{error/keyval}{
4773   Invalid~key=value~pair:#1
4774 }
4775 \msg_new:nnn{stex}{error/instantiate/missing}{
4776   Assignments~missing~in~instantiate:~#1
4777 }
4778 \msg_new:nnn{stex}{error/incompatible}{
4779   Incompatible~signature:~#1~(#2)~and~#3~(#4)
4780 }
4781
```

33.1 Imports with modification

```

4782 <@@=stex_copymodule>
4783 \cs_new_protected:Nn \stex_get_symbol_in_seq:nn {
4784   \tl_if_head_eq_catcode:nNTF { #1 } \relax {
4785     \tl_set:Nn \l_tmpa_tl { #1 }
4786     \__stex_copymodule_get_symbol_from_cs:
4787   }{
4788     % argument is a string
4789     % is it a command name?
4790     \cs_if_exist:cTF { #1 }{
4791       \cs_set_eq:Nc \l_tmpa_tl { #1 }
4792       \str_set:Nx \l_tmpa_str { \cs_argument_spec:N \l_tmpa_tl }
4793       \str_if_empty:NTF \l_tmpa_str {
4794         \exp_args:Nx \cs_if_eq:NNTF {
4795           \tl_head:N \l_tmpa_tl
4796         } \stex_invoke_symbol:n {
4797           \__stex_copymodule_get_symbol_from_cs:n{ #2 }
4798         }{
4799           \__stex_copymodule_get_symbol_from_string:nn { #1 }{ #2 }
4800         }
4801       } {
4802         \__stex_copymodule_get_symbol_from_string:nn { #1 }{ #2 }
4803       }
4804     }{
4805       % argument is not a command name
4806       \__stex_copymodule_get_symbol_from_string:nn { #1 }{ #2 }
4807       % \l_stex_all_symbols_seq
4808     }
4809   }
4810 }
4811
4812 \cs_new_protected:Nn \__stex_copymodule_get_symbol_from_string:nn {
4813   \str_set:Nn \l_tmpa_str { #1 }
4814   \bool_set_false:N \l_tmpa_bool
4815   \bool_if:NF \l_tmpa_bool {
4816     \tl_set:Nn \l_tmpa_tl {
4817       \msg_error:nnn{stex}{error/unknownsymbol}{#1}
4818     }
4819     \str_set:Nn \l_tmpa_str { #1 }
4820     \int_set:Nn \l_tmpa_int { \str_count:N \l_tmpa_str }
4821     \seq_map_inline:Nn #2 {
4822       \str_set:Nn \l_tmpb_str { ##1 }
4823       \str_if_eq:eeT { \l_tmpa_str } {
4824         \str_range:Nnn \l_tmpb_str { -\l_tmpa_int } { -1 }
4825       } {
4826         \seq_map_break:n {
4827           \tl_set:Nn \l_tmpa_tl {
4828             \str_set:Nn \l_stex_get_symbol_uri_str {
4829               ##1
4830             }
4831           }
4832         }
4833       }

```

```

4834     }
4835     \l_tmpa_tl
4836   }
4837 }
4838
4839 \cs_new_protected:Nn \__stex_copymodule_get_symbol_from_cs:n {
4840   \exp_args:NNx \tl_set:Nn \l_tmpa_tl
4841     { \tl_tail:N \l_tmpa_tl }
4842   \tl_if_single:NTF \l_tmpa_tl {
4843     \exp_args:No \tl_if_head_is_group:nTF \l_tmpa_tl {
4844       \exp_after:wN \str_set:Nn \exp_after:wN
4845         \l_stex_get_symbol_uri_str \l_tmpa_tl
4846       \__stex_copymodule_get_symbol_check:n { #1 }
4847     }{
4848       % TODO
4849       % tail is not a single group
4850     }
4851   }{
4852     % TODO
4853     % tail is not a single group
4854   }
4855 }
4856
4857 \cs_new_protected:Nn \__stex_copymodule_get_symbol_check:n {
4858   \exp_args:NNx \seq_if_in:NnF #1 \l_stex_get_symbol_uri_str {
4859     \msg_error:nnxx{stex}{error/copymodule/notallowed}{\l_stex_get_symbol_uri_str}{
4860       :~\seq_use:Nn #1 {,~}
4861     }
4862   }
4863 }
4864
4865 \cs_new_protected:Nn \stex_copymodule_start:nnnn {
4866   % import module
4867   \stex_import_module_uri:nn { #1 } { #2 }
4868   \str_set:Nx \l_stex_current_copymodule_name_str {#3}
4869   \stex_import_require_module:nnnn
4870     { \l_stex_import_ns_str } { \l_stex_import_archive_str }
4871     { \l_stex_import_path_str } { \l_stex_import_name_str }
4872
4873   \stex_collect_imports:n {\l_stex_import_ns_str ?\l_stex_import_name_str }
4874   \seq_set_eq:NN \l__stex_copymodule_copymodule_modules_seq \l_stex_collect_imports_seq
4875
4876   % fields
4877   \seq_clear:N \l__stex_copymodule_copymodule_fields_seq
4878   \seq_map_inline:Nn \l__stex_copymodule_copymodule_modules_seq {
4879     \seq_map_inline:cn {c_stex_module_##1_constants}{
4880       \exp_args:NNx \seq_put_right:Nn \l__stex_copymodule_copymodule_fields_seq {
4881         ##1 ? ####1
4882       }
4883     }
4884   }
4885
4886   % setup prop
4887   \seq_clear:N \l_tmpa_seq

```

```

4888 \exp_args:Nn \prop_set_from_keyval:Nn \l_stex_current_copymodule_prop {
4889   name      = \l_stex_current_copymodule_name_str ,
4890   module    = \l_stex_current_module_str ,
4891   from      = \l_stex_import_ns_str ?\l_stex_import_name_str ,
4892   includes  = \l_tmpa_seq %,
4893   % fields  = \l_tmpa_seq
4894 }
4895 \stex_debug:nn{copymodule}{#4~for~module~{\l_stex_import_ns_str ?\l_stex_import_name_str}
4896   as~\l_stex_current_module_str?\l_stex_current_copymodule_name_str}
4897 \stex_debug:nn{copymodule}{modules:\seq_use:Nn \l__stex_copymodule_copymodule_modules_seq {,
4898 \stex_debug:nn{copymodule}{fields:\seq_use:Nn \l__stex_copymodule_copymodule_fields_seq {,
4899
4900 \stex_if_do_html:T {
4901   \begin{stex_annotate_env} {#4} {
4902     \l_stex_current_module_str?\l_stex_current_copymodule_name_str
4903   }
4904   \stex_annotate_invisible:nnn{domain}{\l_stex_import_ns_str ?\l_stex_import_name_str}{}
4905 }
4906 }
4907
4908 \cs_new_protected:Nn \stex_copymodule_end:n {
4909   % apply to every field
4910   \def \l_tmpa_cs ##1 ##2 {#1}
4911
4912   \tl_clear:N \__stex_copymodule_module_tl
4913   \tl_clear:N \__stex_copymodule_exec_tl
4914
4915   %\prop_get:NnN \l_stex_current_copymodule_prop {fields} \l_tmpa_seq
4916   \seq_clear:N \__stex_copymodule_fields_seq
4917
4918   \seq_map_inline:Nn \l__stex_copymodule_copymodule_modules_seq {
4919     \seq_map_inline:cn {c_stex_module_##1_constants}{
4920
4921       \tl_clear:N \__stex_copymodule_curr_symbol_tl % <- wrap in current symbol html
4922       \l_tmpa_cs{##1}{####1}
4923
4924       \str_if_exist:cTF {l__stex_copymodule_copymodule_##1?####1_name_str} {
4925         \str_set_eq:Nc \__stex_copymodule_curr_name_str {l__stex_copymodule_copymodule_##1?####1_name_str}
4926         \stex_if_do_html:T {
4927           \tl_put_right:Nx \__stex_copymodule_curr_symbol_tl {
4928             \stex_annotate_invisible:nnn{alias}{\use:c{l__stex_copymodule_copymodule_##1?####1_name_str}}
4929           }
4930         }
4931       }{
4932         \str_set:Nx \__stex_copymodule_curr_name_str { \l_stex_current_copymodule_name_str /
4933       }
4934
4935       \prop_set_eq:Nc \l_tmpa_prop {l_stex_symdecl_ ##1?####1_prop}
4936       \prop_put:Nnx \l_tmpa_prop { name } \__stex_copymodule_curr_name_str
4937       \prop_put:Nnx \l_tmpa_prop { module } \l_stex_current_module_str
4938
4939       \tl_if_exist:cT {l__stex_copymodule_copymodule_##1?####1_def_tl}{
4940         \stex_if_do_html:T {
4941           \tl_put_right:Nx \__stex_copymodule_curr_symbol_tl {

```

```

4942     $\stex_annotate_invisible:nnn{definiens}{\exp_after:wN \exp_not:N\csname l__st
4943   }
4944 }
4945 \prop_put:Nnn \l_tmpa_prop { defined } { true }
4946 }
4947
4948 \stex_add_constant_to_current_module:n \__stex_copymodule_curr_name_str
4949 \tl_put_right:Nx \__stex_copymodule_module_tl {
4950   \seq_clear:c {l_stex_symdecl_ \l_stex_current_module_str ? \__stex_copymodule_curr_n
4951   \prop_set_from_keyval:cn {
4952     l_stex_symdecl_ \l_stex_current_module_str ? \__stex_copymodule_curr_name_str _prop
4953   }{
4954     \prop_to_keyval:N \l_tmpa_prop
4955   }
4956 }
4957
4958 \str_if_exist:cT {l__stex_copymodule_copymodule_##1?####1_macroname_str} {
4959   \stex_if_do_html:T {
4960     \tl_put_right:Nx \__stex_copymodule_curr_symbol_tl {
4961       \stex_annotate_invisible:nnn{macroname}{\use:c{l__stex_copymodule_copymodule_##1
4962     }
4963   }
4964   \tl_put_right:Nx \__stex_copymodule_module_tl {
4965     \tl_set:cx {\use:c{l__stex_copymodule_copymodule_##1?####1_macroname_str}}{
4966       \stex_invoke_symbol:n {
4967         \l_stex_current_module_str ? \__stex_copymodule_curr_name_str
4968       }
4969     }
4970   }
4971 }
4972
4973 \seq_put_right:Nx \__stex_copymodule_fields_seq {\l_stex_current_module_str ? \__stex_
4974
4975 \tl_put_right:Nx \__stex_copymodule_exec_tl {
4976   \stex_copy_notations:nn {\l_stex_current_module_str ? \__stex_copymodule_curr_name_s
4977 }
4978
4979 \tl_put_right:Nx \__stex_copymodule_exec_tl {
4980   \stex_if_do_html:TF{
4981     \stex_annotate_invisible:nnn{assignment} {##1?####1} { \exp_after:wN \exp_not:n \e
4982   }{
4983     \exp_after:wN \exp_not:n \exp_after:wN {\__stex_copymodule_curr_symbol_tl}
4984   }
4985 }
4986 }
4987 }
4988
4989
4990 \prop_put:Nno \l_stex_current_copymodule_prop {fields} \__stex_copymodule_fields_seq
4991 \tl_put_left:Nx \__stex_copymodule_module_tl {
4992   \prop_set_from_keyval:cn {
4993     l_stex_copymodule_ \l_stex_current_module_str?\l_stex_current_copymodule_name_str _pro
4994   }{
4995     \prop_to_keyval:N \l_stex_current_copymodule_prop

```

```

4996     }
4997   }
4998
4999   \seq_gput_right:cx{c_stex_module_\l_stex_current_module_str _copymodules}{
5000     \l_stex_current_module_str?\l_stex_current_copymodule_name_str
5001   }
5002
5003   \exp_args:No \stex_execute_in_module:n \__stex_copymodule_module_tl
5004   \stex_debug:nn{copymodule}{result:\meaning \__stex_copymodule_module_tl}
5005   \stex_debug:nn{copymodule}{output:\meaning \__stex_copymodule_exec_tl}
5006
5007   \__stex_copymodule_exec_tl
5008   \stex_if_do_html:T {
5009     \end{stex_annotate_env}
5010   }
5011 }
5012
5013 \NewDocumentEnvironment {copymodule} { 0{} m m}{
5014   \stex_copymodule_start:nnnn { #1 }{ #2 }{ #3 }{ copymodule }
5015   \stex_deactivate_macro:Nn \symdecl {module~environments}
5016   \stex_deactivate_macro:Nn \symdef {module~environments}
5017   \stex_deactivate_macro:Nn \notation {module~environments}
5018   \stex_reactivate_macro:N \assign
5019   \stex_reactivate_macro:N \renamedekl
5020   \stex_reactivate_macro:N \donotcopy
5021   \stex_smsmode_do:
5022 }{
5023   \stex_copymodule_end:n {}
5024 }
5025
5026 \NewDocumentEnvironment {interpretmodule} { 0{} m m}{
5027   \stex_copymodule_start:nnnn { #1 }{ #2 }{ #3 }{ interpretmodule }
5028   \stex_deactivate_macro:Nn \symdecl {module~environments}
5029   \stex_deactivate_macro:Nn \symdef {module~environments}
5030   \stex_deactivate_macro:Nn \notation {module~environments}
5031   \stex_reactivate_macro:N \assign
5032   \stex_reactivate_macro:N \renamedekl
5033   \stex_reactivate_macro:N \donotcopy
5034   \stex_smsmode_do:
5035 }{
5036   \stex_copymodule_end:n {
5037     \tl_if_exist:cF {
5038       l__stex_copymodule_copymodule_##1?##2_def_tl
5039     }{
5040       \str_if_eq:eeF {
5041         \prop_item:cn{
5042           l_stex_symdecl_ ##1 ? ##2 _prop }{ defined }
5043         }{ true }{
5044           \msg_error:nxxx{stex}{error/interpretmodule/nodéfiniens}{
5045             ##1?##2
5046           }{\l_stex_current_copymodule_name_str}
5047         }
5048       }
5049     }

```

```

5050 }
5051
5052 \iffalse \begin{stex_annotate_env} \fi
5053 \NewDocumentEnvironment {realization} { 0{} m}{
5054   \stex_copymodule_start:nnnn { #1 }{ #2 }{ #2 }{ realize }
5055   \stex_deactivate_macro:Nn \symdecl {module~environments}
5056   \stex_deactivate_macro:Nn \symdef {module~environments}
5057   \stex_deactivate_macro:Nn \notation {module~environments}
5058   \stex_reactivate_macro:N \donotcopy
5059   \stex_reactivate_macro:N \assign
5060   \stex_smsmode_do:
5061 }{
5062   \stex_import_module_uri:nn { #1 } { #2 }
5063   \tl_clear:N \__stex_copymodule_exec_tl
5064   \tl_set:Nx \__stex_copymodule_module_tl {
5065     \stex_import_require_module:nnnn
5066     { \l_stex_import_ns_str } { \l_stex_import_archive_str }
5067     { \l_stex_import_path_str } { \l_stex_import_name_str }
5068   }
5069   \exp_args:Nx \stex_add_import_to_current_module:n{
5070     \l_stex_import_ns_str ? \l_stex_import_name_str
5071   }
5072
5073   \seq_map_inline:Nn \l__stex_copymodule_copymodule_modules_seq {
5074     \seq_map_inline:cn {c_stex_module_##1_constants}{
5075       \str_set:Nx \__stex_copymodule_curr_name_str { \l_stex_current_copymodule_name_str / #
5076       \tl_if_exist:cT {l__stex_copymodule_copymodule_##1?####1_def_tl}{
5077         \stex_if_do_html:T {
5078           \tl_put_right:Nx \__stex_copymodule_exec_tl {
5079             \stex_annotate_invisible:nnn{assignment} {##1?####1} {
5080               $\stex_annotate_invisible:nnn{definiens}{}{\exp_after:wN \exp_not:N\csname l__
5081             }
5082           }
5083         }
5084         \tl_put_right:Nx \__stex_copymodule_module_tl {
5085           \prop_put:cnn {l_stex_symdecl_##1?####1_prop}{ defined }{ true }
5086         }
5087       }
5088     }}
5089
5090   \exp_args:No \stex_execute_in_module:n \__stex_copymodule_module_tl
5091
5092   \__stex_copymodule_exec_tl
5093   \stex_if_do_html:T {\end{stex_annotate_env}}
5094 }
5095
5096 \NewDocumentCommand \donotcopy { m }{
5097   \str_clear:N \l_stex_import_name_str
5098   \str_set:Nn \l_tmpa_str { #1 }
5099   \int_set:Nn \l_tmpa_int { \str_count:N \l_tmpa_str }
5100   \seq_map_inline:Nn \l_stex_all_modules_seq {
5101     \str_set:Nn \l_tmpb_str { ##1 }
5102     \str_if_eq:eeT { \l_tmpa_str } {
5103       \str_range:Nnn \l_tmpb_str { -\l_tmpa_int } { -1 }

```

```

5104 } {
5105     \seq_map_break:n {
5106         \stex_if_do_html:T {
5107             \stex_if_smsmode:F {
5108                 \stex_annotate_invisible:nnn{donotcopy}{##1}{
5109                     \stex_annotate:nnn{domain}{##1}{
5110                         }
5111                     }
5112                 }
5113             \str_set_eq:NN \l_stex_import_name_str \l_tmpb_str
5114         }
5115     }
5116     \seq_map_inline:cn {c_stex_module_###1_copymodules}{
5117         \str_set:Nn \l_tmpb_str { ###1 }
5118         \str_if_eq:eeT { \l_tmpa_str } {
5119             \str_range:Nnn \l_tmpb_str { -\l_tmpa_int } { -1 }
5120         } {
5121             \seq_map_break:n {\seq_map_break:n {
5122                 \stex_if_do_html:T {
5123                     \stex_if_smsmode:F {
5124                         \stex_annotate_invisible:nnn{donotcopy}{####1}{
5125                             \stex_annotate:nnn{domain}{
5126                                 \prop_item:cn {l_stex_copymodule_ ####1 _prop}{module}
5127                             }{}
5128                         }
5129                     }
5130                 }
5131                 \str_set:Nx \l_stex_import_name_str {
5132                     \prop_item:cn {l_stex_copymodule_ ####1 _prop}{module}
5133                 }
5134             }}
5135         }
5136     }
5137 }
5138 \str_if_empty:NTF \l_stex_import_name_str {
5139     % TODO throw error
5140 }{
5141     \stex_collect_imports:n {\l_stex_import_name_str }
5142     \seq_map_inline:Nn \l_stex_collect_imports_seq {
5143         \seq_remove_all:Nn \l__stex_copymodule_copymodule_modules_seq { ##1 }
5144         \seq_map_inline:cn {c_stex_module_###1_constants}{
5145             \seq_remove_all:Nn \l__stex_copymodule_copymodule_fields_seq { ##1 ? ####1 }
5146             \bool_lazy_any:nT {
5147                 { \cs_if_exist_p:c {l__stex_copymodule_copymodule_###1?####1_name_str}}
5148                 { \cs_if_exist_p:c {l__stex_copymodule_copymodule_###1?####1_macroname_str}}
5149                 { \cs_if_exist_p:c {l__stex_copymodule_copymodule_###1?####1_def_tl}}
5150             }{
5151                 % TODO throw error
5152             }
5153         }
5154     }
5155     \prop_get:NnN \l_stex_current_copymodule_prop { includes } \l_tmpa_seq
5156     \seq_put_right:Nx \l_tmpa_seq {\l_stex_import_name_str }
5157     \prop_put:Nno \l_stex_current_copymodule_prop {includes} \l_tmpa_seq

```



```

5158 }
5159 \stex_smsmode_do:
5160 }
5161
5162 \NewDocumentCommand \assign { m m }{
5163   \stex_get_symbol_in_seq:nn {#1} \l__stex_copymodule_copymodule_fields_seq
5164   \stex_debug:nn{assign}{defining~{\l_stex_get_symbol_uri_str}~as~\detokenize{#2}}
5165   \tl_set:cn {l__stex_copymodule_copymodule_\l_stex_get_symbol_uri_str _def_tl}{#2}
5166   \stex_smsmode_do:
5167 }
5168
5169 \keys_define:nn { stex / renamedec1 } {
5170   name          .str_set_x:N = \l_stex_renamedec1_name_str
5171 }
5172 \cs_new_protected:Nn \__stex_copymodule_renamedec1_args:n {
5173   \str_clear:N \l_stex_renamedec1_name_str
5174   \keys_set:nn { stex / renamedec1 } { #1 }
5175 }
5176
5177 \NewDocumentCommand \renamedec1 { O{} m m }{
5178   \__stex_copymodule_renamedec1_args:n { #1 }
5179   \stex_get_symbol_in_seq:nn {#2} \l__stex_copymodule_copymodule_fields_seq
5180   \stex_debug:nn{renamedec1}{renaming~{\l_stex_get_symbol_uri_str}~to~#3}
5181   \str_set:cx {l__stex_copymodule_copymodule_\l_stex_get_symbol_uri_str _macroname_str}{#3}
5182   \str_if_empty:NTF \l_stex_renamedec1_name_str {
5183     \tl_set:cx { #3 }{ \stex_invoke_symbol:n {
5184       \l_stex_get_symbol_uri_str
5185     } }
5186   } {
5187     \str_set:cx {l__stex_copymodule_copymodule_\l_stex_get_symbol_uri_str _name_str}{\l_stex
5188     \stex_debug:nn{renamedec1}{@~\l_stex_current_module_str ? \l_stex_renamedec1_name_str}
5189     \prop_set_eq:cc {l_stex_symdecl_
5190       \l_stex_current_module_str ? \l_stex_renamedec1_name_str
5191     _prop
5192     }{l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop}
5193     \seq_set_eq:cc {l_stex_symdecl_
5194       \l_stex_current_module_str ? \l_stex_renamedec1_name_str
5195     _notations
5196     }{l_stex_symdecl_ \l_stex_get_symbol_uri_str _notations}
5197     \prop_put:cnx {l_stex_symdecl_
5198       \l_stex_current_module_str ? \l_stex_renamedec1_name_str
5199     _prop
5200     }{ name }{ \l_stex_renamedec1_name_str }
5201     \prop_put:cnx {l_stex_symdecl_
5202       \l_stex_current_module_str ? \l_stex_renamedec1_name_str
5203     _prop
5204     }{ module }{ \l_stex_current_module_str }
5205     \exp_args:NNx \seq_put_left:Nn \l__stex_copymodule_copymodule_fields_seq {
5206       \l_stex_current_module_str ? \l_stex_renamedec1_name_str
5207     }
5208     \tl_set:cx { #3 }{ \stex_invoke_symbol:n {
5209       \l_stex_current_module_str ? \l_stex_renamedec1_name_str
5210     } }
5211   }

```

```

5212 \stex_smsmode_do:
5213 }
5214
5215 \stex_deactivate_macro:Nn \assign {copymodules}
5216 \stex_deactivate_macro:Nn \renamedekl {copymodules}
5217 \stex_deactivate_macro:Nn \donotcopy {copymodules}
5218
5219

```

33.2 The feature environment

`structural@feature (env.)`

```

5220 <@@=stex_features>
5221
5222 \NewDocumentEnvironment{structural_feature_module}{ m m m }{
5223   \stex_if_in_module:F {
5224     \msg_set:nnn{stex}{error/nomodule}{
5225       Structural~Feature~has~to~occur~in~a~module:\\
5226       Feature~#2~of~type~#1\\
5227       In~File:~\stex_path_to_string:N \g_stex_currentfile_seq
5228     }
5229     \msg_error:nn{stex}{error/nomodule}
5230   }
5231
5232   \str_set_eq:NN \l_stex_feature_parent_str \l_stex_current_module_str
5233
5234   \stex_module_setup:nn{meta=NONE}{#2 - #1}
5235
5236   \stex_if_do_html:T {
5237     \begin{stex_annotate_env}{ feature:#1 }{\l_stex_feature_parent_str ? #2 - #1}
5238     \stex_annotate_invisible:nnn{header}{}{ #3 }
5239   }
5240 }{
5241   \str_gset_eq:NN \l_stex_last_feature_str \l_stex_current_module_str
5242   \prop_gput:cnn {c_stex_module_ \l_stex_current_module_str _prop}{feature}{#1}
5243   \stex_debug:nn{features}{
5244     Feature: \l_stex_last_feature_str
5245   }
5246   \stex_if_do_html:T {
5247     \end{stex_annotate_env}
5248   }
5249 }

```

33.3 Structure

`structure (env.)`

```

5250 <@@=stex_structures>
5251 \cs_new_protected:Nn \stex_add_structure_to_current_module:nn {
5252   \prop_if_exist:cF {c_stex_module_ \l_stex_current_module_str _structures}{
5253     \prop_new:c {c_stex_module_ \l_stex_current_module_str _structures}
5254   }
5255   \prop_gput:cxx{c_stex_module_ \l_stex_current_module_str _structures}

```

```

5256     {#1}{#2}
5257 }
5258
5259 \keys_define:nn { stex / features / structure } {
5260   name          .str_set_x:N = \l__stex_structures_name_str ,
5261 }
5262
5263 \cs_new_protected:Nn \__stex_structures_structure_args:n {
5264   \str_clear:N \l__stex_structures_name_str
5265   \keys_set:nn { stex / features / structure } { #1 }
5266 }
5267 \NewDocumentEnvironment{mathstructure}{m O{}}{
5268   \begin{mathstructure_inner}{#1}[#2]
5269     \stex_smsmode_do:
5270     \ignorespacesandpars
5271   }\end{mathstructure_inner}}
5272 \NewDocumentEnvironment{mathstructure_inner}{m O{}}{
5273   \__stex_structures_structure_args:n { #2 }
5274   \str_if_empty:NT \l__stex_structures_name_str {
5275     \str_set:Nx \l__stex_structures_name_str { #1 }
5276   }
5277   \stex_suppress_html:n {
5278     \bool_set_true:N \l_stex_symdecl_make_macro_bool
5279     \exp_args:Nx \stex_symdecl_do:nn {
5280       name = \l__stex_structures_name_str ,
5281       def = {\STEXsymbol{module-type}}{
5282         \STEXInternalTermMathOMSiiii {
5283           \prop_item:cn {c_stex_module_\l_stex_current_module_str _prop}
5284             { ns } ?
5285           \prop_item:cn {c_stex_module_\l_stex_current_module_str _prop}
5286             { name } / \l__stex_structures_name_str - structure
5287         }{}{}{}
5288       }}
5289     }{ #1 }
5290   }
5291   \exp_args:Nnnx
5292   \begin{structural_feature_module}{ structure }
5293     { \l__stex_structures_name_str }{}
5294 }{
5295   \end{structural_feature_module}
5296   \_stex_reset_up_to_module:n \l_stex_last_feature_str
5297   \exp_args:No \stex_collect_imports:n \l_stex_last_feature_str
5298   \seq_clear:N \l_tmpa_seq
5299   \seq_map_inline:Nn \l_stex_collect_imports_seq {
5300     \seq_map_inline:cn{c_stex_module_##1_constants}{
5301       \seq_put_right:Nn \l_tmpa_seq { ##1 ? ####1 }
5302     }
5303   }
5304   \exp_args:Nnno
5305   \prop_gput:cn {c_stex_module_ \l_stex_last_feature_str _prop}{fields}\l_tmpa_seq
5306   \stex_debug:nn{structure}{Fields:~\seq_use:Nn \l_tmpa_seq ,}
5307   \stex_add_structure_to_current_module:nn
5308     \l__stex_structures_name_str
5309     \l_stex_last_feature_str

```

```

5310
5311 \stex_execute_in_module:x {
5312   \tl_set:cn { #1 }{
5313     \exp_not:N \stex_invoke_structure:nn {\l_stex_current_module_str }{ \l__stex_structures
5314   }
5315 }
5316 }
5317
5318 \cs_new:Nn \stex_invoke_structure:nn {
5319   \stex_invoke_symbol:n { #1?#2 }
5320 }
5321
5322 \cs_new_protected:Nn \stex_get_structure:n {
5323   \tl_if_head_eq_catcode:nNTF { #1 } \relax {
5324     \tl_set:Nn \l_tmpa_tl { #1 }
5325     \__stex_structures_get_from_cs:
5326   }{
5327     \cs_if_exist:cTF { #1 }{
5328       \cs_set_eq:Nc \l_tmpa_cs { #1 }
5329       \str_set:Nx \l_tmpa_str {\cs_argument_spec:N \l_tmpa_cs }
5330       \str_if_empty:NNTF \l_tmpa_str {
5331         \cs_if_eq:NNTF { \tl_head:N \l_tmpa_cs} \stex_invoke_structure:nn {
5332           \__stex_structures_get_from_cs:
5333         }{
5334           \__stex_structures_get_from_string:n { #1 }
5335         }
5336       }{
5337         \__stex_structures_get_from_string:n { #1 }
5338       }
5339     }{
5340       \__stex_structures_get_from_string:n { #1 }
5341     }
5342   }
5343 }
5344
5345 \cs_new_protected:Nn \__stex_structures_get_from_cs: {
5346   \exp_args:NNx \tl_set:Nn \l_tmpa_tl
5347   { \tl_tail:N \l_tmpa_tl }
5348   \str_set:Nx \l_tmpa_str {
5349     \exp_after:wN \use_i:nn \l_tmpa_tl
5350   }
5351   \str_set:Nx \l_tmpb_str {
5352     \exp_after:wN \use_ii:nn \l_tmpa_tl
5353   }
5354   \str_set:Nx \l_stex_get_structure_str {
5355     \l_tmpa_str ? \l_tmpb_str
5356   }
5357   \str_set:Nx \l_stex_get_structure_module_str {
5358     \exp_args:Nno \prop_item:cn {c_stex_module_\l_tmpa_str _structures}{\l_tmpb_str}
5359   }
5360 }
5361
5362 \cs_new_protected:Nn \__stex_structures_get_from_string:n {
5363   \tl_set:Nn \l_tmpa_tl {

```

```

5364 \msg_error:nnn{stex}{error/unknownstructure}{#1}
5365 }
5366 \str_set:Nn \l_tmpa_str { #1 }
5367 \int_set:Nn \l_tmpa_int { \str_count:N \l_tmpa_str }
5368
5369 \seq_map_inline:Nn \l_stex_all_modules_seq {
5370   \prop_if_exist:cT {c_stex_module_##1_structures} {
5371     \prop_map_inline:cn {c_stex_module_##1_structures} {
5372       \exp_args:No \str_if_eq:nnT \l_tmpa_str {####1}{
5373         %\str_if_eq:eeT { \l_tmpa_str }{ \str_range:nnn {##1?####1}{-\l_tmpa_int}{-1}}{
5374         \prop_map_break:n{\seq_map_break:n{
5375           \tl_set:Nn \l_tmpa_tl {
5376             \str_set:Nn \l_stex_get_structure_str {##1?####1}
5377             \str_set:Nn \l_stex_get_structure_module_str {####2}
5378           }
5379         }}
5380       }
5381     }
5382   }
5383 }
5384 \l_tmpa_tl
5385 }

```

\instantiate

```

5386
5387 \NewDocumentEnvironment{usestructure}{m}{
5388   \stex_get_structure:n {#1}
5389   \exp_args:Nnx \stex_debug:nn{features}{using~structure:~\l_stex_get_structure_module_str}
5390   \exp_args:No \stex_activate_module:n \l_stex_get_structure_module_str
5391 }{}
5392
5393 \keys_define:nn { stex / instantiate } {
5394   name .str_set_x:N = \l__stex_structures_name_str
5395 }
5396 \cs_new_protected:Nn \__stex_structures_instantiate_args:n {
5397   \str_clear:N \l__stex_structures_name_str
5398   \keys_set:nn { stex / instantiate } { #1 }
5399 }
5400
5401 \NewDocumentEnvironment{extstructure}{m m O{}}{
5402   \begin{mathstructure_inner}{#1}[#3]
5403     \seq_set_split:Nnn\__stex_structures_extstructure_imports_seq,{#2}
5404     \seq_map_inline:Nn\__stex_structures_extstructure_imports_seq {
5405       \stex_get_structure:n {##1}
5406       \exp_args:Nnx \stex_debug:nn{features}{importing~structure:~\l_stex_get_structure_modu
5407       \exp_args:No \stex_activate_module:n \l_stex_get_structure_module_str
5408       \stex_if_smsmode:F {
5409         \stex_annotate_invisible:nnn
5410         {import} {\l_stex_get_structure_module_str} {}
5411       }
5412       \exp_args:Nx \stex_add_import_to_current_module:n {
5413         \l_stex_get_structure_module_str
5414       }
5415       \exp_args:Nx \stex_add_to_current_module:n {

```

```

5416         \exp_args:No \stex_activate_module:n \l_stex_get_structure_module_str
5417     }
5418 }
5419 \stex_smsmode_do:
5420 \ignorespacesandpars
5421 }{
5422 \end{mathstructure_inner}
5423 }
5424
5425 \NewDocumentEnvironment{extstructure*}{m m O{}}{
5426 % TODO
5427 \begin{extstructure}{#1}{#2}{#3}
5428 }{
5429 \end{extstructure}
5430 }
5431
5432 \NewDocumentCommand \instantiate {m O{ } m m O{}}{
5433 \begin{group}
5434 \stex_get_structure:n {#3}
5435 \__stex_structures_instantiate_args:n { #2 }
5436 \str_if_empty:NT \l__stex_structures_name_str {
5437 \str_set:Nn \l__stex_structures_name_str { #1 }
5438 }
5439 \exp_args:No \stex_activate_module:n \l_stex_get_structure_module_str
5440 \seq_clear:N \l__stex_structures_fields_seq
5441 \exp_args:Nx \stex_collect_imports:n \l_stex_get_structure_module_str
5442 \seq_map_inline:Nn \l_stex_collect_imports_seq {
5443 \seq_map_inline:cn {c_stex_module_##1_constants}{
5444 \seq_put_right:Nx \l__stex_structures_fields_seq { ##1 ? #####1 }
5445 }
5446 }
5447
5448 \tl_if_empty:nF{#5}{
5449 \seq_set_split:Nnn \l_tmpa_seq , {#5}
5450 \prop_clear:N \l_tmpa_prop
5451 \seq_map_inline:Nn \l_tmpa_seq {
5452 \seq_set_split:Nnn \l_tmpb_seq = { ##1 }
5453 \int_compare:nNnF { \seq_count:N \l_tmpb_seq } = 2 {
5454 \msg_error:nnn{stex}{error/keyval}{##1}
5455 }
5456 \exp_args:Nx \stex_get_symbol_in_seq:nn {\seq_item:Nn \l_tmpb_seq 1} \l__stex_struct
5457 \str_set_eq:NN \l__stex_structures_dom_str \l_stex_get_symbol_uri_str
5458 \exp_args:NNx \seq_remove_all:Nn \l__stex_structures_fields_seq \l_stex_get_symbol_u
5459 \exp_args:Nx \stex_get_symbol:n {\seq_item:Nn \l_tmpb_seq 2}
5460 \exp_args:Nxx \str_if_eq:nnF
5461 {\prop_item:cn{l_stex_symdecl_\l__stex_structures_dom_str _prop}{args}}
5462 {\prop_item:cn{l_stex_symdecl_\l_stex_get_symbol_uri_str _prop}{args}}{
5463 \msg_error:nnxxx{stex}{error/incompatible}
5464 {\l__stex_structures_dom_str}
5465 {\prop_item:cn{l_stex_symdecl_\l__stex_structures_dom_str _prop}{args}}
5466 {\l_stex_get_symbol_uri_str}
5467 {\prop_item:cn{l_stex_symdecl_\l_stex_get_symbol_uri_str _prop}{args}}
5468 }
5469 \prop_put:Nxx \l_tmpa_prop {\seq_item:Nn \l_tmpb_seq 1} \l_stex_get_symbol_uri_str

```

```

5470     }
5471 }
5472
5473 \seq_map_inline:Nn \l__stex_structures_fields_seq {
5474   \str_set:Nx \l_tmpa_str {field:\l__stex_structures_name_str . \prop_item:cn {l_stex_sy
5475   \stex_debug:nn{instantiate}{Field~\l_tmpa_str :~##1}
5476
5477   \stex_add_constant_to_current_module:n {\l_tmpa_str}
5478   \stex_execute_in_module:x {
5479     \prop_set_from_keyval:cn { l_stex_symdecl_ \l_stex_current_module_str?\l_tmpa_str _p
5480       name   = \l_tmpa_str ,
5481       args   = \prop_item:cn {l_stex_symdecl_##1_prop}{args} ,
5482       arity  = \prop_item:cn {l_stex_symdecl_##1_prop}{arity} ,
5483       assocs = \prop_item:cn {l_stex_symdecl_##1_prop}{assocs} ,
5484       argnames = {\prop_item:cn {l_stex_symdecl_##1_prop}{argnames}}
5485     }
5486     \seq_clear:c {l_stex_symdecl_\l_stex_current_module_str?\l_tmpa_str _notations}
5487   }
5488
5489   \seq_if_empty:cF{l_stex_symdecl_##1_notations}{
5490     \stex_find_notation:nn{##1}{ }
5491     \stex_execute_in_module:x {
5492       \seq_put_right:cn {l_stex_symdecl_\l_stex_current_module_str?\l_tmpa_str _notation
5493     }
5494
5495     \stex_copy_control_sequence_ii:ccN
5496     {stex_notation_\l_stex_current_module_str?\l_tmpa_str\c_hash_str \l_stex_notation_
5497     {stex_notation_##1\c_hash_str \l_stex_notation_variant_str _cs}
5498     \l_tmpa_tl
5499     \exp_args:No \stex_execute_in_module:n \l_tmpa_tl
5500
5501
5502     \cs_if_exist:cT{stex_op_notation_##1\c_hash_str \l_stex_notation_variant_str _cs}{
5503       \tl_set_eq:Nc \l_tmpa_cs {stex_op_notation_##1\c_hash_str \l_stex_notation_variant
5504       \stex_execute_in_module:x {
5505         \tl_set:cn
5506         {stex_op_notation_\l_stex_current_module_str?\l_tmpa_str\c_hash_str \l_stex_not
5507         { \exp_args:No \exp_not:n \l_tmpa_cs}
5508       }
5509     }
5510
5511   }
5512
5513   \prop_put:Nxx \l_tmpa_prop {\prop_item:cn {l_stex_symdecl_##1_prop}{name}}{\l_stex_cur
5514 }
5515
5516 \stex_execute_in_module:x {
5517   \prop_set_from_keyval:cn {l_stex_instance_\l_stex_current_module_str?\l__stex_structur
5518   domain = \l_stex_get_structure_module_str ,
5519   \prop_to_keyval:N \l_tmpa_prop
5520 }
5521 \tl_set:cn{ #1 }{\stex_invoke_instance:n{ \l_stex_current_module_str?\l__stex_structur
5522 }
5523 \stex_debug:nn{instantiate}{

```

```

5524 Instance~\l_stex_current_module_str?\l__stex_structures_name_str \\  

5525 \prop_to_keyval:N \l_tmpa_prop  

5526 }  

5527 \exp_args:Nxx \stex_symdecl_do:nn {  

5528   type={\STEXsymbol{module-type}}{  

5529     \STEXInternalTermMathOMSiiii {  

5530       \l_stex_get_structure_module_str  

5531     }{}{0}{}  

5532   }}  

5533 }{\l__stex_structures_name_str}  

5534 % {  

5535   \str_set:Nx \l_stex_get_symbol_uri_str {\l_stex_current_module_str?\l__stex_structures  

5536   \tl_set:Nn \l_stex_notation_after_do_tl {\__stex_notation_final:}  

5537   \stex_notation_do:nnnnn{}{0}{}{\comp{#4}}  

5538 % }  

5539 %\exp_args:Nx \notation{\l__stex_structures_name_str}{\comp{#5}}  

5540 \endgroup  

5541 \stex_smsmode_do:\ignorespacesandpars  

5542 }  

5543  

5544 \cs_new_protected:Nn \stex_symbol_or_var:n {  

5545   \cs_if_exist:cTF{#1}{  

5546     \cs_set_eq:Nc \l_tmpa_tl { #1 }  

5547     \str_set:Nx \l_tmpa_str { \cs_argument_spec:N \l_tmpa_tl }  

5548     \str_if_empty:NNTF \l_tmpa_str {  

5549       \exp_args:Nx \cs_if_eq:NNTF { \tl_head:N \l_tmpa_tl }  

5550       \stex_invoke_variable:n {  

5551         \bool_set_true:N \l_stex_symbol_or_var_bool  

5552         \bool_set_false:N \l_stex_instance_or_symbol_bool  

5553         \tl_set:Nx \l_tmpa_tl {\tl_tail:N \l_tmpa_tl}  

5554         \tl_set:Nx \l_tmpa_tl {\exp_after:wN \use:n \l_tmpa_tl}  

5555         \str_set:Nx \l_stex_get_symbol_uri_str {  

5556           \exp_after:wN \use:n \l_tmpa_tl  

5557         }  

5558       }{ % TODO \stex_invoke_varinstance:n  

5559         \exp_args:Nx \cs_if_eq:NNTF { \tl_head:N \l_tmpa_tl } \stex_invoke_varinstance:n {  

5560           \bool_set_true:N \l_stex_symbol_or_var_bool  

5561           \bool_set_true:N \l_stex_instance_or_symbol_bool  

5562           \tl_set:Nx \l_tmpa_tl {\tl_tail:N \l_tmpa_tl}  

5563           \tl_set:Nx \l_tmpa_tl {\exp_after:wN \use:n \l_tmpa_tl}  

5564           \str_set:Nx \l_stex_get_symbol_uri_str {  

5565             \exp_after:wN \use:n \l_tmpa_tl  

5566           }  

5567         }{  

5568           \bool_set_false:N \l_stex_symbol_or_var_bool  

5569           \stex_get_symbol:n{#1}  

5570         }  

5571       }  

5572     }{  

5573       \__stex_structures_symbolorvar_from_string:n{ #1 }  

5574     }  

5575   }{  

5576     \__stex_structures_symbolorvar_from_string:n{ #1 }  

5577   }  


```



```

5578 }
5579
5580 \cs_new_protected:Nn \__stex_structures_symbolorvar_from_string:n {
5581   \prop_if_exist:cTF {l_stex_symdecl_var://#1 _prop}{
5582     \bool_set_true:N \l_stex_symbol_or_var_bool
5583     \str_set:Nn \l_stex_get_symbol_uri_str { #1 }
5584   }{
5585     \bool_set_false:N \l_stex_symbol_or_var_bool
5586     \stex_get_symbol:n{#1}
5587   }
5588 }
5589
5590 \keys_define:nn { stex / varinstantiate } {
5591   name .str_set_x:N = \l__stex_structures_name_str,
5592   bind .choices:nn =
5593     {forall,exists}
5594     {\str_set:Nx \l__stex_structures_bind_str {\l_keys_choice_tl}}
5595 }
5596
5597 \cs_new_protected:Nn \__stex_structures_varinstantiate_args:n {
5598   \str_clear:N \l__stex_structures_name_str
5599   \str_clear:N \l__stex_structures_bind_str
5600   \keys_set:nn { stex / varinstantiate } { #1 }
5601 }
5602
5603 \NewDocumentCommand \varinstantiate {m O{}} m m O{}}{
5604   \begin{group}
5605     \stex_get_structure:n {#3}
5606     \__stex_structures_varinstantiate_args:n { #2 }
5607     \str_if_empty:NT \l__stex_structures_name_str {
5608       \str_set:Nn \l__stex_structures_name_str { #1 }
5609     }
5610     \stex_if_do_html:TF{
5611       \stex_annotate:nnn{varinstance}{\l__stex_structures_name_str}
5612     }{\use:n}
5613     {
5614       \stex_if_do_html:T{
5615         \stex_annotate_invisible:nnn{domain}{\l_stex_get_structure_module_str}{}
5616       }
5617       \seq_clear:N \l__stex_structures_fields_seq
5618       \exp_args:Nx \stex_collect_imports:n \l_stex_get_structure_module_str
5619       \seq_map_inline:Nn \l_stex_collect_imports_seq {
5620         \seq_map_inline:cn {c_stex_module_##1_constants}{
5621           \seq_put_right:Nx \l__stex_structures_fields_seq { ##1 ? ####1 }
5622         }
5623       }
5624       \exp_args:No \stex_activate_module:n \l_stex_get_structure_module_str
5625       \prop_clear:N \l_tmpa_prop
5626       \tl_if_empty:nF {#5} {
5627         \seq_set_split:Nnn \l_tmpa_seq , {#5}
5628         \seq_map_inline:Nn \l_tmpa_seq {
5629           \seq_set_split:Nnn \l_tmpb_seq = { ##1 }
5630           \int_compare:nNnF { \seq_count:N \l_tmpb_seq } = 2 {
5631             \msg_error:nnn{stex}{error/keyval}{##1}

```

```

5632     }
5633     \exp_args:Nx \stex_get_symbol_in_seq:nn {\seq_item:Nn \l_tmpb_seq 1} \l__stex_structures_dom_str
5634     \str_set_eq:NN \l__stex_structures_dom_str \l_stex_get_symbol_uri_str
5635     \exp_args:NNx \seq_remove_all:Nn \l__stex_structures_fields_seq \l_stex_get_symbol_uri_str
5636     \exp_args:Nx \stex_symbol_or_var:n {\seq_item:Nn \l_tmpb_seq 2}
5637     \stex_if_do_html:T{
5638         \stex_annotate:nnn{assign}{\l__stex_structures_dom_str,
5639         \bool_if:NTF\l_stex_symbol_or_var_bool{var://}{\l_stex_get_symbol_uri_str}{}}
5640     }
5641     \bool_if:NTF \l_stex_symbol_or_var_bool {
5642         \exp_args:Nxx \str_if_eq:nnF
5643         {\prop_item:cn{l_stex_symdecl_\l__stex_structures_dom_str _prop}{args}}
5644         {\prop_item:cn{l_stex_symdecl_var://\l_stex_get_symbol_uri_str _prop}{args}}}{
5645         \msg_error:nnxxxx{stex}{error/incompatible}
5646         {\l__stex_structures_dom_str}
5647         {\prop_item:cn{l_stex_symdecl_\l__stex_structures_dom_str _prop}{args}}
5648         {\l_stex_get_symbol_uri_str}
5649         {\prop_item:cn{l_stex_symdecl_var://\l_stex_get_symbol_uri_str _prop}{args}}
5650     }
5651     \prop_put:Nxx \l_tmpa_prop {\seq_item:Nn \l_tmpb_seq 1} {\stex_invoke_variable:n {
5652 }}{
5653     \exp_args:Nxx \str_if_eq:nnF
5654     {\prop_item:cn{l_stex_symdecl_\l__stex_structures_dom_str _prop}{args}}
5655     {\prop_item:cn{l_stex_symdecl_\l_stex_get_symbol_uri_str _prop}{args}}}{
5656     \msg_error:nnxxxx{stex}{error/incompatible}
5657     {\l__stex_structures_dom_str}
5658     {\prop_item:cn{l_stex_symdecl_\l__stex_structures_dom_str _prop}{args}}
5659     {\l_stex_get_symbol_uri_str}
5660     {\prop_item:cn{l_stex_symdecl_\l_stex_get_symbol_uri_str _prop}{args}}
5661     }
5662     \prop_put:Nxx \l_tmpa_prop {\seq_item:Nn \l_tmpb_seq 1} {\stex_invoke_symbol:n {
5663 }}{
5664     }
5665 }
5666 \tl_gclear:N \g__stex_structures_aftergroup_tl
5667 \seq_map_inline:Nn \l__stex_structures_fields_seq {
5668     \str_set:Nx \l_tmpa_str {\l__stex_structures_name_str . \prop_item:cn {l_stex_symdecl_
5669     \stex_debug:nn{varinstantiate}{Field~\l_tmpa_str :~##1}
5670     \seq_if_empty:cF{l_stex_symdecl_##1_notations}{
5671         \stex_find_notation:nn{##1}{}
5672         \cs_gset_eq:cc{g__stex_structures_tmpa_\l_tmpa_str _cs}
5673         {stex_notation_##1\c_hash_str \l_stex_notation_variant_str _cs}
5674         \stex_debug:nn{varinstantiate}{Notation:~\cs_meaning:c{g__stex_structures_tmpa_\l_
5675         \cs_if_exist:cT{stex_op_notation_##1\c_hash_str \l_stex_notation_variant_str _cs}{
5676         \cs_gset_eq:cc {g__stex_structures_tmpa_op_\l_tmpa_str _cs}
5677         {stex_op_notation_##1\c_hash_str \l_stex_notation_variant_str _cs}
5678         \stex_debug:nn{varinstantiate}{Operator~Notation:~\cs_meaning:c{g__stex_struct
5679     }
5680 }
5681
5682 \exp_args:NNx \tl_gput_right:Nn \g__stex_structures_aftergroup_tl {
5683     \prop_set_from_keyval:cn { l_stex_symdecl_ var://\l_tmpa_str _prop}{
5684         name      = \l_tmpa_str ,
5685         args      = \prop_item:cn {l_stex_symdecl_##1_prop}{args} ,

```

```

5686         arity = \prop_item:cn {l_stex_symdecl_##1_prop}{arity} ,
5687         assocs = \prop_item:cn {l_stex_symdecl_##1_prop}{assocs} ,
5688         argnames = {\prop_item:cn {l_stex_symdecl_##1_prop}{argnames}} ,
5689     }
5690     \cs_set_eq:cc {stex_var_notation_\l_tmpa_str_cs}
5691     {g__stex_structures_tmpa_\l_tmpa_str_cs}
5692     \cs_set_eq:cc {stex_var_op_notation_\l_tmpa_str_cs}
5693     {g__stex_structures_tmpa_op_\l_tmpa_str_cs}
5694 }
5695 \prop_put:Nxx \l_tmpa_prop {\prop_item:cn {l_stex_symdecl_##1_prop}{name}}{\stex_inv
5696 }
5697 \exp_args:NNx \tl_gput_right:Nn \g__stex_structures_aftergroup_tl {
5698     \prop_set_from_keyval:cn {l_stex_varinstance_\l__stex_structures_name_str_prop }{
5699         domain = \l_stex_get_structure_module_str ,
5700         \prop_to_keyval:N \l_tmpa_prop
5701     }
5702     \tl_set:cn { #1 }{\stex_invoke_varinstance:n {\l__stex_structures_name_str}}
5703     \tl_set:cn {l_stex_varinstance_\l__stex_structures_name_str_op_tl}{
5704         \exp_args:Nnx \exp_not:N \use:nn {
5705             \str_set:Nn \exp_not:N \STEXInternalCurrentSymbolStr {var://\l__stex_structures_
5706                 \_stex_term_omv:nn {var://\l__stex_structures_name_str}{
5707                     \exp_not:n{
5708                         \_varcomp{#4}
5709                     }
5710                 }
5711             }{
5712                 \exp_not:n{\_stex_reset:N \STEXInternalCurrentSymbolStr}
5713             }
5714         }
5715     }
5716 }
5717 \stex_debug:nn{varinstantiate}{\expandafter\detokenize\expandafter{\g__stex_structures_a
5718 \aftergroup\g__stex_structures_aftergroup_tl
5719 \endgroup
5720 \stex_smsmode_do:\ignorespacesandpars
5721 }
5722
5723 \cs_new_protected:Nn \stex_invoke_instance:n {
5724     \peek_charcode_remove:NTF ! {
5725         \stex_invoke_symbol:n{#1}
5726     }{
5727         \_stex_invoke_instance:nn {#1}
5728     }
5729 }
5730
5731
5732 \cs_new_protected:Nn \stex_invoke_varinstance:n {
5733     \peek_charcode_remove:NTF ! {
5734         \exp_args:Nnx \use:nn {
5735             \def\comp{\_varcomp}
5736             \use:c{l_stex_varinstance_#1_op_tl}
5737         }{
5738             \_stex_reset:N \comp
5739         }

```

```

5740 }{
5741   \_stex_invoke_varinstance:nn {#1}
5742 }
5743 }
5744
5745 \cs_new_protected:Nn \_stex_invoke_instance:nn {
5746   \prop_if_in:cnTF {l_stex_instance_ #1 _prop}{#2}{
5747     \exp_args:Nx \stex_invoke_symbol:n {\prop_item:cn{l_stex_instance_ #1 _prop}{#2}}
5748   }{
5749     \prop_set_eq:Nc \l_tmpa_prop{l_stex_instance_ #1 _prop}
5750     \msg_error:nnxxx{stex}{error/unknownfield}{#2}{#1}{
5751       \prop_to_keyval:N \l_tmpa_prop
5752     }
5753   }
5754 }
5755
5756 \cs_new_protected:Nn \_stex_invoke_varinstance:nn {
5757   \prop_if_in:cnTF {l_stex_varinstance_ #1 _prop}{#2}{
5758     \prop_get:cnN{l_stex_varinstance_ #1 _prop}{#2}\l_tmpa_tl
5759     \l_tmpa_tl
5760   }{
5761     \msg_error:nnnnn{stex}{error/unknownfield}{#2}{#1}{
5762     }
5763   }

```

(End definition for \instantiate. This function is documented on page 38.)

\stex_invoke_structure:nnn

```

5764 % #1: URI of the instance
5765 % #2: URI of the instantiated module
5766 \cs_new_protected:Nn \stex_invoke_structure:nnn {
5767   \tl_if_empty:nTF{ #3 }{
5768     \prop_set_eq:Nc \l__stex_structures_structure_prop {
5769       c_stex_feature_ #2 _prop
5770     }
5771     \tl_clear:N \l_tmpa_tl
5772     \prop_get:NnN \l__stex_structures_structure_prop { fields } \l_tmpa_seq
5773     \seq_map_inline:Nn \l_tmpa_seq {
5774       \seq_set_split:Nnn \l_tmpb_seq ? { ##1 }
5775       \seq_get_right:NN \l_tmpb_seq \l_tmpa_str
5776       \cs_if_exist:cT {
5777         stex_notation_ #1/\l_tmpa_str \c_hash_str\c_hash_str _cs
5778       }{
5779         \tl_if_empty:NF \l_tmpa_tl {
5780           \tl_put_right:Nn \l_tmpa_tl {,}
5781         }
5782         \tl_put_right:Nx \l_tmpa_tl {
5783           \stex_invoke_symbol:n {#1/\l_tmpa_str}!
5784         }
5785       }
5786     }
5787     \exp_args:No \mathstrut \l_tmpa_tl
5788   }{
5789     \stex_invoke_symbol:n{#1/#3}

```

```

5790 }
5791 }

(End definition for \stex_invoke_structure:nnn. This function is documented on page ??.)

5792 </package>

```

Chapter 34

STEX -Statements Implementation

```
5793 <*package>
5794
5795 %%%%%%%%%%% features.dtx %%%%%%%%%%%
5796
5797 <@@=stex_statements>
    Warnings and error messages
5798
\titleemph
5799 \def\titleemph#1{\textbf{#1}}
    (End definition for \titleemph. This function is documented on page ??.)
```

34.1 Definitions

definiendum

```
5800 \keys_define:nn {stex / definiendum }{
5801   pre      .tl_set:N      = \l__stex_statements_definiendum_pre_tl,
5802   post     .tl_set:N      = \l__stex_statements_definiendum_post_tl,
5803   root     .str_set_x:N    = \l__stex_statements_definiendum_root_str,
5804   gfa      .str_set_x:N    = \l__stex_statements_definiendum_gfa_str
5805 }
5806 \cs_new_protected:Nn \__stex_statements_definiendum_args:n {
5807   \str_clear:N \l__stex_statements_definiendum_root_str
5808   \tl_clear:N \l__stex_statements_definiendum_post_tl
5809   \str_clear:N \l__stex_statements_definiendum_gfa_str
5810   \keys_set:nn { stex / definiendum }{ #1 }
5811 }
5812 \NewDocumentCommand \definiendum { O{} m m } {
5813   \__stex_statements_definiendum_args:n { #1 }
5814   \stex_get_symbol:n { #2 }
5815   \stex_ref_new_sym_target:n \l_stex_get_symbol_uri_str
5816   \str_if_empty:NTF \l__stex_statements_definiendum_root_str {
5817     \tl_if_empty:NTF \l__stex_statements_definiendum_post_tl {
```

```

5818     \tl_set:Nn \l_tmpa_tl { #3 }
5819   } {
5820     \str_set:Nx \l__stex_statements_definiendum_root_str { #3 }
5821     \tl_set:Nn \l_tmpa_tl {
5822       \l__stex_statements_definiendum_pre_tl\l__stex_statements_definiendum_root_str\l__st
5823     }
5824   }
5825 } {
5826   \tl_set:Nn \l_tmpa_tl { #3 }
5827 }
5828
5829 % TODO root
5830 \stex_html_backend:TF {
5831   \stex_annotate:nnn { definiendum } { \l_stex_get_symbol_uri_str } { \l_tmpa_tl }
5832 } {
5833   \exp_args:Nnx \defemph@uri { \l_tmpa_tl } { \l_stex_get_symbol_uri_str }
5834 }
5835 }
5836 \stex_deactivate_macro:Nn \definiendum {definition~environments}

```

(End definition for definiendum. This function is documented on page 48.)

definame

```

5837
5838 \NewDocumentCommand \definame { 0{ } m } {
5839   \__stex_statements_definiendum_args:n { #1 }
5840   % TODO: root
5841   \stex_get_symbol:n { #2 }
5842   \stex_ref_new_sym_target:n \l_stex_get_symbol_uri_str
5843   \str_set:Nx \l_tmpa_str {
5844     \prop_item:cn { l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop } { name }
5845   }
5846   \str_replace_all:Nnn \l_tmpa_str {-} {~}
5847   \stex_html_backend:TF {
5848     \stex_if_do_html:T {
5849       \stex_annotate:nnn { definiendum } { \l_stex_get_symbol_uri_str } {
5850         \l_tmpa_str\l__stex_statements_definiendum_post_tl
5851       }
5852     }
5853   } {
5854     \exp_args:Nnx \defemph@uri {
5855       \l_tmpa_str\l__stex_statements_definiendum_post_tl
5856     } { \l_stex_get_symbol_uri_str }
5857   }
5858 }
5859 \stex_deactivate_macro:Nn \definame {definition~environments}
5860
5861 \NewDocumentCommand \Definame { 0{ } m } {
5862   \__stex_statements_definiendum_args:n { #1 }
5863   \stex_get_symbol:n { #2 }
5864   \str_set:Nx \l_tmpa_str {
5865     \prop_item:cn { l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop } { name }
5866   }
5867   \exp_args:NNno \str_replace_all:Nnn \l_tmpa_str {-} {~}

```

```

5868 \stex_ref_new_sym_target:n \l_stex_get_symbol_uri_str
5869 \stex_html_backend:TF {
5870   \stex_if_do_html:T {
5871     \stex_annotate:nnn { definiendum } { \l_stex_get_symbol_uri_str } {
5872       \exp_after:wN \stex_capitalize:n \l_tmpa_str\l__stex_statements_definiendum_post_tl
5873     }
5874   }
5875 } {
5876   \exp_args:Nnx \defemph@uri {
5877     \exp_after:wN \stex_capitalize:n \l_tmpa_str\l__stex_statements_definiendum_post_tl
5878   } { \l_stex_get_symbol_uri_str }
5879 }
5880 }
5881 \stex_deactivate_macro:Nn \Definame {definition-environments}
5882
5883 \NewDocumentCommand \premise { m }{
5884   \noindent\stex_annotate:nnn{ premise }{}{\ignorespaces #1 }
5885 }
5886 \NewDocumentCommand \conclusion { m }{
5887   \noindent\stex_annotate:nnn{ conclusion }{}{\ignorespaces #1 }
5888 }
5889 \NewDocumentCommand \definiens { 0{} m }{
5890   \str_clear:N \l_stex_get_symbol_uri_str
5891   \tl_if_empty:nF {#1} {
5892     \stex_get_symbol:n { #1 }
5893   }
5894   \str_if_empty:NT \l_stex_get_symbol_uri_str {
5895     \int_compare:nNnTF {\clist_count:N \l__stex_statements_sdefinition_for_clist} = 1 {
5896       \str_set:Nx \l_stex_get_symbol_uri_str {\clist_item:Nn \l__stex_statements_sdefinition
5897     }{
5898       % TODO throw error
5899     }
5900   }
5901   \str_if_eq:eeT {\prop_item:cn {l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop}{module}}
5902   {\l_stex_current_module_str}{
5903     \str_if_eq:eeF {\prop_item:cn {l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop}{defin
5904   }{true}{
5905     \prop_put:cnn{l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop}{defined}{true}
5906     \exp_args:Nx \stex_add_to_current_module:n {
5907       \prop_put:cnn{l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop}{defined}{true}
5908     }
5909   }
5910 }
5911 \stex_annotate:nnn{ definiens }{\l_stex_get_symbol_uri_str}{ #2 }
5912 }
5913
5914 \NewDocumentCommand \varbindforall {m}{
5915   \stex_symbol_or_var:n {#1}
5916   \bool_if:NTF\l_stex_symbol_or_var_bool{
5917     \stex_if_do_html:T {
5918       \stex_annotate_invisible:nnn {bindtype}{forall,\l_stex_get_symbol_uri_str}{}
5919     }
5920   }{
5921     % todo throw error

```



```

5922 }
5923 }
5924
5925 \stex_deactivate_macro:Nn \premise {definition,~example~or~assertion~environments}
5926 \stex_deactivate_macro:Nn \conclusion {example~or~assertion~environments}
5927 \stex_deactivate_macro:Nn \definiens {definition~environments}
5928 \stex_deactivate_macro:Nn \varbindforall {definition~or~assertion~environments}
5929

```

(End definition for definame. This function is documented on page 48.)

sdefinition (env.)

```

5930
5931 \keys_define:nn {stex / sdefinition }{
5932   type      .str_set_x:N = \sdefinitiontype,
5933   id        .str_set_x:N = \sdefinitionid,
5934   name      .str_set_x:N = \sdefinitionname,
5935   for       .clist_set:N = \l__stex_statements_sdefinition_for_clist ,
5936   title     .tl_set:N     = \sdefinitiontitle
5937 }
5938 \cs_new_protected:Nn \__stex_statements_sdefinition_args:n {
5939   \str_clear:N \sdefinitiontype
5940   \str_clear:N \sdefinitionid
5941   \str_clear:N \sdefinitionname
5942   \clist_clear:N \l__stex_statements_sdefinition_for_clist
5943   \tl_clear:N \sdefinitiontitle
5944   \keys_set:nn { stex / sdefinition }{ #1 }
5945 }
5946
5947 \NewDocumentEnvironment{sdefinition}{0{}}{
5948   \__stex_statements_sdefinition_args:n{ #1 }
5949   \stex_reactivate_macro:N \definiendum
5950   \stex_reactivate_macro:N \definame
5951   \stex_reactivate_macro:N \Definame
5952   \stex_reactivate_macro:N \premise
5953   \stex_reactivate_macro:N \definiens
5954   \stex_reactivate_macro:N \varbindforall
5955   \stex_if_smsmode:F{
5956     \seq_clear:N \l_tmpb_seq
5957     \clist_map_inline:Nn \l__stex_statements_sdefinition_for_clist {
5958       \tl_if_empty:nF{ ##1 }{
5959         \stex_get_symbol:n { ##1 }
5960         \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
5961           \l_stex_get_symbol_uri_str
5962         }
5963       }
5964     }
5965     \clist_set_from_seq:NN \l__stex_statements_sdefinition_for_clist \l_tmpb_seq
5966     \exp_args:Nnnx
5967     \begin{stex_annotate_env}{definition}{\seq_use:Nn \l_tmpb_seq {,}}
5968     \str_if_empty:NF \sdefinitiontype {
5969       \stex_annotate_invisible:nnn{typestrings}{\sdefinitiontype}{}
5970     }
5971     \str_if_empty:NF \sdefinitionname {

```

```

5972     \stex_annotate_invisible:nnn{statementname}{\sdefinitionname}{}
5973   }
5974   \clist_set:No \l_tmpa_clist \sdefinitiontype
5975   \tl_clear:N \l_tmpa_tl
5976   \clist_map_inline:Nn \l_tmpa_clist {
5977     \tl_if_exist:cT {__stex_statements_sdefinition_##1_start:}{
5978       \tl_set:Nn \l_tmpa_tl {
5979         \stex_patch_counters:
5980         \use:c{__stex_statements_sdefinition_##1_start:}
5981         \stex_unpatch_counters:
5982       }
5983     }
5984   }
5985   \tl_if_empty:NTF \l_tmpa_tl {
5986     \__stex_statements_sdefinition_start:
5987   }{
5988     \l_tmpa_tl
5989   }
5990 }
5991 \stex_ref_new_doc_target:n \sdefinitionid
5992 \stex_smsmode_do:
5993 ){
5994   \stex_suppress_html:n {
5995     \str_if_empty:NF \sdefinitionname { \stex_symdecl_do:nn{}{\sdefinitionname} }
5996   }
5997   \stex_if_smsmode:F {
5998     \clist_set:No \l_tmpa_clist \sdefinitiontype
5999     \tl_clear:N \l_tmpa_tl
6000     \clist_map_inline:Nn \l_tmpa_clist {
6001       \tl_if_exist:cT {__stex_statements_sdefinition_##1_end:}{
6002         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sdefinition_##1_end:}}
6003       }
6004     }
6005     \tl_if_empty:NTF \l_tmpa_tl {
6006       \__stex_statements_sdefinition_end:
6007     }{
6008       \l_tmpa_tl
6009     }
6010     \end{stex_annotate_env}
6011   }
6012 }

```

\stexpatchdefinition

```

6013 \cs_new_protected:Nn \__stex_statements_sdefinition_start: {
6014   \stex_par:\noindent\titleemph{Definition\tl_if_empty:NF \sdefinitiontitle {
6015     ~(\sdefinitiontitle)
6016   }~}
6017 }
6018 \cs_new_protected:Nn \__stex_statements_sdefinition_end: {\stex_par:\medskip}
6019
6020 \newcommand\stexpatchdefinition[3] [] {
6021   \str_set:Nx \l_tmpa_str{ #1 }
6022   \str_if_empty:NTF \l_tmpa_str {
6023     \tl_set:Nn \__stex_statements_sdefinition_start: { #2 }

```

```

6024     \tl_set:Nn \__stex_statements_sdefinition_end: { #3 }
6025   }{
6026     \exp_after:wN \tl_set:Nn \csname __stex_statements_sdefinition_#1_start:\endcsname{ #2
6027     \exp_after:wN \tl_set:Nn \csname __stex_statements_sdefinition_#1_end:\endcsname{ #3 }
6028   }
6029 }

```

(End definition for `\stexpatchdefinition`. This function is documented on page 55.)

`\inlinedef` inline:

```

6030 \keys_define:nn {stex / inlinedef }{
6031   type      .str_set_x:N = \sdefinitiontype,
6032   id        .str_set_x:N = \sdefinitionid,
6033   for       .clist_set:N = \l__stex_statements_sdefinition_for_clist ,
6034   name      .str_set_x:N = \sdefinitionname
6035 }
6036 \cs_new_protected:Nn \__stex_statements_inlinedef_args:n {
6037   \str_clear:N \sdefinitiontype
6038   \str_clear:N \sdefinitionid
6039   \str_clear:N \sdefinitionname
6040   \clist_clear:N \l__stex_statements_sdefinition_for_clist
6041   \keys_set:nn { stex / inlinedef }{ #1 }
6042 }
6043 \NewDocumentCommand \inlinedef { 0{} m } {
6044   \beginingroup
6045   \__stex_statements_inlinedef_args:n{ #1 }
6046   \stex_reactivate_macro:N \definiendum
6047   \stex_reactivate_macro:N \definame
6048   \stex_reactivate_macro:N \Definame
6049   \stex_reactivate_macro:N \premise
6050   \stex_reactivate_macro:N \definiens
6051   \stex_reactivate_macro:N \varbindforall
6052   \stex_ref_new_doc_target:n \sdefinitionid
6053   \stex_if_smsmode:TF{\stex_suppress_html:n {
6054     \str_if_empty:NF \sdefinitionname { \stex_symdecl_do:nn{}{\sdefinitionname} }
6055   }}{
6056     \seq_clear:N \l_tmpb_seq
6057     \clist_map_inline:Nn \l__stex_statements_sdefinition_for_clist {
6058       \tl_if_empty:nF{ ##1 }{
6059         \stex_get_symbol:n { ##1 }
6060         \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
6061           \l_stex_get_symbol_uri_str
6062         }
6063       }
6064     }
6065     \clist_set_from_seq:NN \l__stex_statements_sdefinition_for_clist \l_tmpb_seq
6066     \ifvmode\noindent\fi
6067     \exp_args:Nnx
6068     \stex_annotate:nnn{definition}{\seq_use:Nn \l_tmpb_seq {,}}{
6069       \str_if_empty:NF \sdefinitiontype {
6070         \stex_annotate_invisible:nnn{typestrings}{\sdefinitiontype}{}
6071       }
6072       #2
6073       \str_if_empty:NF \sdefinitionname {

```

```

6074         \stex_suppress_html:n{\stex_symdecl_do:nn}{\sdefinitionname}}
6075         \stex_annotate_invisible:nnn{statementname}{\sdefinitionname}{}}
6076     }
6077 }
6078 }
6079 \endgroup
6080 \stex_smsmode_do:
6081 }

```

(End definition for `\inlinedef`. This function is documented on page ??.)

34.2 Assertions

`sassertion (env.)`

```

6082
6083 \keys_define:nn {stex / sassertion }{
6084   type      .str_set_x:N = \sassertiontype,
6085   id        .str_set_x:N = \sassertionid,
6086   title     .tl_set:N    = \sassertiontitle ,
6087   for       .clist_set:N = \l__stex_statements_sassertion_for_clist ,
6088   name      .str_set_x:N = \sassertionname
6089 }
6090 \cs_new_protected:Nn \__stex_statements_sassertion_args:n {
6091   \str_clear:N \sassertiontype
6092   \str_clear:N \sassertionid
6093   \str_clear:N \sassertionname
6094   \clist_clear:N \l__stex_statements_sassertion_for_clist
6095   \tl_clear:N \sassertiontitle
6096   \keys_set:nn { stex / sassertion }{ #1 }
6097 }
6098
6099 %\tl_new:N \g__stex_statements_aftergroup_tl
6100
6101 \NewDocumentEnvironment{sassertion}{0{}}{
6102   \__stex_statements_sassertion_args:n{ #1 }
6103   \stex_reactivate_macro:N \premise
6104   \stex_reactivate_macro:N \conclusion
6105   \stex_reactivate_macro:N \varbindforall
6106   \stex_if_smsmode:F {
6107     \seq_clear:N \l_tmpb_seq
6108     \clist_map_inline:Nn \l__stex_statements_sassertion_for_clist {
6109       \tl_if_empty:nF{ ##1 }{
6110         \stex_get_symbol:n { ##1 }
6111         \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
6112           \l_stex_get_symbol_uri_str
6113         }
6114       }
6115     }
6116     \exp_args:Nnnx
6117     \begin{sassertion}{\seq_use:Nn \l_tmpb_seq {,}}
6118     \str_if_empty:NF \sassertiontype {
6119       \stex_annotate_invisible:nnn{type}{\sassertiontype}{}}
6120   }

```

```

6121 \str_if_empty:NF \sassertionname {
6122   \stex_annotate_invisible:nnn{statementname}{\sassertionname}{\}
6123 }
6124 \clist_set:No \l_tmpa_clist \sassertiontype
6125 \tl_clear:N \l_tmpa_tl
6126 \clist_map_inline:Nn \l_tmpa_clist {
6127   \tl_if_exist:cT {__stex_statements_sassertion_##1_start:}{
6128     \tl_set:Nn \l_tmpa_tl {
6129       \stex_patch_counters:
6130       \use:c{__stex_statements_sassertion_##1_start:}
6131       \stex_unpatch_counters:
6132     }
6133   }
6134 }
6135 \tl_if_empty:NTF \l_tmpa_tl {
6136   \__stex_statements_sassertion_start:
6137 }{
6138   \l_tmpa_tl
6139 }
6140 }
6141 \str_if_empty:NTF \sassertionid {
6142   \str_if_empty:NF \sassertionname {
6143     \stex_ref_new_doc_target:n {}
6144   }
6145 } {
6146   \stex_ref_new_doc_target:n \sassertionid
6147 }
6148 \stex_smsmode_do:
6149 }{
6150   \str_if_empty:NF \sassertionname {
6151     \stex_suppress_html:n{\stex_symdecl_do:nn{}{\sassertionname}}
6152     \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sassertionname}
6153   }
6154   \stex_if_smsmode:F {
6155     \clist_set:No \l_tmpa_clist \sassertiontype
6156     \tl_clear:N \l_tmpa_tl
6157     \clist_map_inline:Nn \l_tmpa_clist {
6158       \tl_if_exist:cT {__stex_statements_sassertion_##1_end:}{
6159         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sassertion_##1_end:}}
6160       }
6161     }
6162     \tl_if_empty:NTF \l_tmpa_tl {
6163       \__stex_statements_sassertion_end:
6164     }{
6165       \l_tmpa_tl
6166     }
6167     \end{stex_annotate_env}
6168   }
6169 }

```

\stexpatchassertion

```

6170
6171 \cs_new_protected:Nn \__stex_statements_sassertion_start: {
6172   \stex_par:\noindent\titilemph{Assertion~\tl_if_empty:NF \sassertiontitle {

```

```

6173      (\sassertiontitle)
6174    }~}
6175  }
6176  \cs_new_protected:Nn \__stex_statements_sassertion_end: {\stex_par:\medskip}
6177
6178  \newcommand\stexpatchassertion[3] [] {
6179    \str_set:Nx \l_tmpa_str{ #1 }
6180    \str_if_empty:NTF \l_tmpa_str {
6181      \tl_set:Nn \__stex_statements_sassertion_start: { #2 }
6182      \tl_set:Nn \__stex_statements_sassertion_end: { #3 }
6183    }{
6184      \exp_after:wN \tl_set:Nn \csname __stex_statements_sassertion_#1_start:\endcsname{ #2
6185      \exp_after:wN \tl_set:Nn \csname __stex_statements_sassertion_#1_end:\endcsname{ #3 }
6186    }
6187  }

```

(End definition for `\stexpatchassertion`. This function is documented on page 55.)

`\inlineass` inline:

```

6188  \keys_define:nn {stex / inlineass }{
6189    type      .str_set_x:N = \sassertiontype,
6190    id        .str_set_x:N = \sassertionid,
6191    for       .clist_set:N = \l__stex_statements_sassertion_for_clist ,
6192    name      .str_set_x:N = \sassertionname
6193  }
6194  \cs_new_protected:Nn \__stex_statements_inlineass_args:n {
6195    \str_clear:N \sassertiontype
6196    \str_clear:N \sassertionid
6197    \str_clear:N \sassertionname
6198    \clist_clear:N \l__stex_statements_sassertion_for_clist
6199    \keys_set:nn { stex / inlineass }{ #1 }
6200  }
6201  \NewDocumentCommand \inlineass { 0{} m } {
6202    \begingroup
6203    \stex_reactivate_macro:N \premise
6204    \stex_reactivate_macro:N \conclusion
6205    \stex_reactivate_macro:N \varbindforall
6206    \__stex_statements_inlineass_args:n{ #1 }
6207    \str_if_empty:NTF \sassertionid {
6208      \str_if_empty:NF \sassertionname {
6209        \stex_ref_new_doc_target:n {}
6210      }
6211    } {
6212      \stex_ref_new_doc_target:n \sassertionid
6213    }
6214
6215    \stex_if_smsmode:TF{
6216      \str_if_empty:NF \sassertionname {
6217        \stex_suppress_html:n{\stex_symdecl_do:nn}{\sassertionname}}
6218        \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sassertionname}
6219      }
6220    }{
6221      \seq_clear:N \l_tmpb_seq
6222      \clist_map_inline:Nn \l__stex_statements_sassertion_for_clist {

```

```

6223     \tl_if_empty:nF{ ##1 }{
6224         \stex_get_symbol:n { ##1 }
6225         \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
6226             \l_stex_get_symbol_uri_str
6227         }
6228     }
6229 }
6230 \ifvmode\noindent\fi
6231 \exp_args:Nnx
6232 \stex_annotate:nnn{assertion}{\seq_use:Nn \l_tmpb_seq {,}}{
6233     \str_if_empty:NF \sassertiontype {
6234         \stex_annotate_invisible:nnn{typestrings}{\sassertiontype}{}
6235     }
6236     #2
6237     \str_if_empty:NF \sassertionname {
6238         \stex_suppress_html:n{\stex_symdecl_do:nn{}}{\sassertionname}}
6239         \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sassertionname}
6240         \stex_annotate_invisible:nnn{statementname}{\sassertionname}{}
6241     }
6242 }
6243 }
6244 \endgroup
6245 \stex_smsmode_do:
6246 }

```

(End definition for `\inlineass`. This function is documented on page ??.)

34.3 Examples

`sexample (env.)`

```

6247
6248 \keys_define:nn {stex / sexample }{
6249     type      .str_set_x:N = \exampletype,
6250     id        .str_set_x:N = \sexampleid,
6251     title     .tl_set:N    = \sexampletitle,
6252     name      .str_set_x:N = \sexamplename ,
6253     for       .clist_set:N = \l__stex_statements_sexample_for_clist,
6254 }
6255 \cs_new_protected:Nn \__stex_statements_sexample_args:n {
6256     \str_clear:N \sexampletype
6257     \str_clear:N \sexampleid
6258     \str_clear:N \sexamplename
6259     \tl_clear:N \sexampletitle
6260     \clist_clear:N \l__stex_statements_sexample_for_clist
6261     \keys_set:nn { stex / sexample }{ #1 }
6262 }
6263
6264 \NewDocumentEnvironment{sexample}{0{}}{
6265     \__stex_statements_sexample_args:n{ #1 }
6266     \stex_reactivate_macro:N \premise
6267     \stex_reactivate_macro:N \conclusion
6268     \stex_if_smsmode:F {
6269         \seq_clear:N \l_tmpb_seq

```

```

6270 \clist_map_inline:Nn \l__stex_statements_sexample_for_clist {
6271   \tl_if_empty:NF{ ##1 }{
6272     \stex_get_symbol:n { ##1 }
6273     \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
6274       \l_stex_get_symbol_uri_str
6275     }
6276   }
6277 }
6278 \exp_args:Nnnx
6279 \begin{stex_annotate_env}{example}{\seq_use:Nn \l_tmpb_seq {,}}
6280 \str_if_empty:NF \sexamplotype {
6281   \stex_annotate_invisible:nnn{typestrings}{\sexampletype}{\}
6282 }
6283 \str_if_empty:NF \sexamplename {
6284   \stex_annotate_invisible:nnn{statementname}{\sexamplename}{\}
6285 }
6286 \clist_set:No \l_tmpa_clist \sexamplotype
6287 \tl_clear:N \l_tmpa_tl
6288 \clist_map_inline:Nn \l_tmpa_clist {
6289   \tl_if_exist:cT {__stex_statements_sexample_##1_start:}{
6290     \tl_set:Nn \l_tmpa_tl {
6291       \stex_patch_counters:
6292       \use:c{__stex_statements_sexample_##1_start:}
6293       \stex_unpatch_counters:
6294     }
6295   }
6296 }
6297 \tl_if_empty:NTF \l_tmpa_tl {
6298   \__stex_statements_sexample_start:
6299 }{
6300   \l_tmpa_tl
6301 }
6302 }
6303 \str_if_empty:NF \sexampleid {
6304   \stex_ref_new_doc_target:n \sexampleid
6305 }
6306 \stex_smsmode_do:
6307 ){
6308   \str_if_empty:NF \sexamplename {
6309     \stex_suppress_html:n{\stex_symdecl_do:nn{}{\sexamplename}}
6310   }
6311   \stex_if_smsmode:F {
6312     \clist_set:No \l_tmpa_clist \sexamplotype
6313     \tl_clear:N \l_tmpa_tl
6314     \clist_map_inline:Nn \l_tmpa_clist {
6315       \tl_if_exist:cT {__stex_statements_sexample_##1_end:}{
6316         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sexample_##1_end:}}
6317       }
6318     }
6319     \tl_if_empty:NTF \l_tmpa_tl {
6320       \__stex_statements_sexample_end:
6321     }{
6322       \l_tmpa_tl
6323     }

```



```

6324     \end{stex_annotate_env}
6325   }
6326 }

```

`\stexpatchexample`

```

6327
6328 \cs_new_protected:Nn \__stex_statements_sexample_start: {
6329   \stex_par:\noindent\titleemph{Example~\tl_if_empty:NF \sexampletile {
6330     (\sexampletile)
6331   }~}
6332 }
6333 \cs_new_protected:Nn \__stex_statements_sexample_end: {\stex_par:\medskip}
6334
6335 \newcommand\stexpatchexample[3] [] {
6336   \str_set:Nx \l_tmpa_str{ #1 }
6337   \str_if_empty:NTF \l_tmpa_str {
6338     \tl_set:Nn \__stex_statements_sexample_start: { #2 }
6339     \tl_set:Nn \__stex_statements_sexample_end: { #3 }
6340   }{
6341     \exp_after:wN \tl_set:Nn \csname __stex_statements_sexample_#1_start:\endcsname{ #2 }
6342     \exp_after:wN \tl_set:Nn \csname __stex_statements_sexample_#1_end:\endcsname{ #3 }
6343   }
6344 }

```

(End definition for `\stexpatchexample`. This function is documented on page 55.)

`\inlineex` inline:

```

6345 \keys_define:nn {stex / inlineex }{
6346   type      .str_set_x:N = \sexamplotype,
6347   id        .str_set_x:N = \sexampleid,
6348   for       .clist_set:N = \l__stex_statements_sexample_for_clist ,
6349   name      .str_set_x:N = \sexamplename
6350 }
6351 \cs_new_protected:Nn \__stex_statements_inlineex_args:n {
6352   \str_clear:N \sexamplotype
6353   \str_clear:N \sexampleid
6354   \str_clear:N \sexamplename
6355   \clist_clear:N \l__stex_statements_sexample_for_clist
6356   \keys_set:nn { stex / inlineex }{ #1 }
6357 }
6358 \NewDocumentCommand \inlineex { 0{} m } {
6359   \begingroup
6360   \stex_reactivate_macro:N \premise
6361   \stex_reactivate_macro:N \conclusion
6362   \__stex_statements_inlineex_args:n{ #1 }
6363   \str_if_empty:NF \sexampleid {
6364     \stex_ref_new_doc_target:n \sexampleid
6365   }
6366   \stex_if_smsmode:TF{
6367     \str_if_empty:NF \sexamplename {
6368       \stex_suppress_html:n{\stex_symdecl_do:nn{}}{\sexamplename}}
6369   }
6370 }{
6371   \seq_clear:N \l_tmpb_seq

```

```

6372 \clist_map_inline:Nn \l__stex_statements_sexample_for_clist {
6373   \tl_if_empty:NF{ ##1 }{
6374     \stex_get_symbol:n { ##1 }
6375     \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
6376       \l_stex_get_symbol_uri_str
6377     }
6378   }
6379 }
6380 \ifvmode\noindent\fi
6381 \exp_args:Nnx
6382 \stex_annotate:nnn{example}{\seq_use:Nn \l_tmpb_seq {,}}{
6383   \str_if_empty:NF \sexamplotype {
6384     \stex_annotate_invisible:nnn{typestrings}{\sexamplotype}{}
6385   }
6386   #2
6387   \str_if_empty:NF \sexamplename {
6388     \stex_suppress_html:n{\stex_symdecl_do:nn{}{\sexamplename}}
6389     \stex_annotate_invisible:nnn{statementname}{\sexamplename}{}
6390   }
6391 }
6392 }
6393 \endgroup
6394 \stex_smsmode_do:
6395 }

```

(End definition for \inlineex. This function is documented on page ??.)

34.4 Logical Paragraphs

sparagraph (*env.*)

```

6396 \keys_define:nn { stex / sparagraph } {
6397   id      .str_set:x:N = \sparagraphid ,
6398   title   .tl_set:N    = \l_stex_sparagraph_title_tl ,
6399   type    .str_set:x:N = \sparagraphtype ,
6400   for     .clist_set:N = \l__stex_statements_sparagraph_for_clist ,
6401   from    .tl_set:N    = \sparagraphfrom ,
6402   to      .tl_set:N    = \sparagraphto ,
6403   start   .tl_set:N    = \l_stex_sparagraph_start_tl ,
6404   name    .str_set:N   = \sparagraphname ,
6405   imports .tl_set:N    = \l__stex_statements_sparagraph_imports_tl
6406 }
6407
6408 \cs_new_protected:Nn \stex_sparagraph_args:n {
6409   \tl_clear:N \l_stex_sparagraph_title_tl
6410   \tl_clear:N \sparagraphfrom
6411   \tl_clear:N \sparagraphto
6412   \tl_clear:N \l_stex_sparagraph_start_tl
6413   \tl_clear:N \l__stex_statements_sparagraph_imports_tl
6414   \str_clear:N \sparagraphid
6415   \str_clear:N \sparagraphtype
6416   \clist_clear:N \l__stex_statements_sparagraph_for_clist
6417   \str_clear:N \sparagraphname
6418   \keys_set:nn { stex / sparagraph }{ #1 }

```

```

6419 }
6420 \newif\if@in@omtext\@in@omtextfalse
6421
6422 \NewDocumentEnvironment {sparagraph} { 0{} } {
6423   \stex_sparagraph_args:n { #1 }
6424   \tl_if_empty:NTF \l_stex_sparagraph_start_tl {
6425     \tl_set_eq:NN \sparagraphtitle \l_stex_sparagraph_title_tl
6426   }{
6427     \tl_set_eq:NN \sparagraphtitle \l_stex_sparagraph_start_tl
6428   }
6429   \@in@omtexttrue
6430   \stex_if_smsmode:F {
6431     \seq_clear:N \l_tmpb_seq
6432     \clist_map_inline:Nn \l__stex_statements_sparagraph_for_clist {
6433       \tl_if_empty:NF{ ##1 }{
6434         \stex_get_symbol:n { ##1 }
6435         \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
6436           \l_stex_get_symbol_uri_str
6437         }
6438       }
6439     }
6440     \exp_args:Nnnx
6441     \begin{stex_annotate_env}{paragraph}{\seq_use:Nn \l_tmpb_seq {},}}
6442     \str_if_empty:NF \sparagraphtype {
6443       \stex_annotate_invisible:nnn{typestrings}{\sparagraphtype}{}
6444     }
6445     \str_if_empty:NF \sparagraphfrom {
6446       \stex_annotate_invisible:nnn{from}{\sparagraphfrom}{}
6447     }
6448     \str_if_empty:NF \sparagraphto {
6449       \stex_annotate_invisible:nnn{to}{\sparagraphto}{}
6450     }
6451     \str_if_empty:NF \sparagraphname {
6452       \stex_annotate_invisible:nnn{statementname}{\sparagraphname}{}
6453     }
6454     \clist_set:No \l_tmpa_clist \sparagraphtype
6455     \tl_clear:N \l_tmpa_tl
6456     \clist_map_inline:Nn \sparagraphtype {
6457       \tl_if_exist:cT {__stex_statements_sparagraph_##1_start:}{
6458         \tl_set:Nn \l_tmpa_tl {
6459           \stex_patch_counters:
6460           \use:c{__stex_statements_sparagraph_##1_start:}
6461           \stex_unpatch_counters:
6462         }
6463       }
6464     }
6465     \stex_csl_to_imports:No \usemodule \l__stex_statements_sparagraph_imports_tl
6466     \tl_if_empty:NTF \l_tmpa_tl {
6467       \__stex_statements_sparagraph_start:
6468     }{
6469       \l_tmpa_tl
6470     }
6471   }
6472   \clist_set:No \l_tmpa_clist \sparagraphtype

```

```

6473 \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\tl_to_str:n{syndoc}}
6474 {
6475   \stex_reactivate_macro:N \definiendum
6476   \stex_reactivate_macro:N \definame
6477   \stex_reactivate_macro:N \Definame
6478   \stex_reactivate_macro:N \premise
6479   \stex_reactivate_macro:N \definiens
6480 }
6481 \str_if_empty:NTF \sparagraphid {
6482   \str_if_empty:NTF \sparagraphname {
6483     \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\tl_to_str:n{syndoc}}{
6484       \stex_ref_new_doc_target:n {}
6485     }
6486   } {
6487     \stex_ref_new_doc_target:n {}
6488   }
6489 } {
6490   \stex_ref_new_doc_target:n \sparagraphid
6491 }
6492 \exp_args:NNx
6493 \clist_if_in:NnT \l_tmpa_clist {\tl_to_str:n{syndoc}}{
6494   \clist_map_inline:Nn \l__stex_statements_sparagraph_for_clist {
6495     \tl_if_empty:nF{ ##1 }{
6496       \stex_get_symbol:n { ##1 }
6497       \stex_ref_new_sym_target:n \l_stex_get_symbol_uri_str
6498     }
6499   }
6500 }
6501 \stex_smsmode_do:
6502 \ignorespacesandpars
6503 }{
6504   \str_if_empty:NF \sparagraphname {
6505     \stex_suppress_html:n{\stex_symdecl_do:nn{}{\sparagraphname}}
6506     \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sparagraphname}
6507   }
6508   \stex_if_smsmode:F {
6509     \clist_set:No \l_tmpa_clist \sparagraphtype
6510     \tl_clear:N \l_tmpa_tl
6511     \clist_map_inline:Nn \l_tmpa_clist {
6512       \tl_if_exist:cT {__stex_statements_sparagraph_##1_end:}{
6513         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sparagraph_##1_end:}}
6514       }
6515     }
6516     \tl_if_empty:NTF \l_tmpa_tl {
6517       \__stex_statements_sparagraph_end:
6518     }{
6519       \l_tmpa_tl
6520     }
6521     \end{stex_annotate_env}
6522   }
6523 }

```

\stexpatchparagraph

6524

```

6525 \cs_new_protected:Nn \__stex_statements_sparagraph_start: {
6526   \stex_par:\noindent\tl_if_empty:NTF \l_stex_sparagraph_start_tl {
6527     \tl_if_empty:NF \l_stex_sparagraph_title_tl {
6528       \titleemph{\l_stex_sparagraph_title_tl}:~
6529     }
6530   }{
6531     \titleemph{\l_stex_sparagraph_start_tl}~
6532   }
6533 }
6534 \cs_new_protected:Nn \__stex_statements_sparagraph_end: {\stex_par:\medskip}
6535
6536 \newcommand\stexpatchparagraph[3] [] {
6537   \str_set:Nx \l_tmpa_str{ #1 }
6538   \str_if_empty:NTF \l_tmpa_str {
6539     \tl_set:Nn \__stex_statements_sparagraph_start: { #2 }
6540     \tl_set:Nn \__stex_statements_sparagraph_end: { #3 }
6541   }{
6542     \exp_after:wN \tl_set:Nn \csname __stex_statements_sparagraph_#1_start:\endcsname{ #2
6543     \exp_after:wN \tl_set:Nn \csname __stex_statements_sparagraph_#1_end:\endcsname{ #3 }
6544   }
6545 }
6546
6547 \keys_define:nn { stex / inlinepara } {
6548   id      .str_set:N = \sparagraphid ,
6549   type    .str_set:N = \sparagraphtype ,
6550   for     .clist_set:N = \l__stex_statements_sparagraph_for_clist ,
6551   from    .tl_set:N   = \sparagraphfrom ,
6552   to      .tl_set:N   = \sparagraphto ,
6553   name    .str_set:N   = \sparagraphname
6554 }
6555 \cs_new_protected:Nn \__stex_statements_inlinepara_args:n {
6556   \tl_clear:N \sparagraphfrom
6557   \tl_clear:N \sparagraphto
6558   \str_clear:N \sparagraphid
6559   \str_clear:N \sparagraphtype
6560   \clist_clear:N \l__stex_statements_sparagraph_for_clist
6561   \str_clear:N \sparagraphname
6562   \keys_set:nn { stex / inlinepara }{ #1 }
6563 }
6564 \NewDocumentCommand \inlinepara { 0{} m } {
6565   \begingroup
6566   \__stex_statements_inlinepara_args:n{ #1 }
6567   \clist_set:No \l_tmpa_clist \sparagraphtype
6568   \str_if_empty:NTF \sparagraphid {
6569     \str_if_empty:NTF \sparagraphname {
6570       \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\tl_to_str:n{symdoc}}{
6571         \stex_ref_new_doc_target:n {}
6572       }
6573     } {
6574       \stex_ref_new_doc_target:n {}
6575     }
6576   } {
6577     \stex_ref_new_doc_target:n \sparagraphid
6578   }

```

```

6579 \stex_if_smsmode:TF{
6580   \str_if_empty:NF \sparagraphname {
6581     \stex_suppress_html:n{\stex_symdecl_do:nn{}}{\sparagraphname}}
6582     \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sparagraphname}
6583   }
6584 }{
6585   \seq_clear:N \l_tmpb_seq
6586   \clist_map_inline:Nn \l__stex_statements_sparagraph_for_clist {
6587     \tl_if_empty:NF{ ##1 }{
6588       \stex_get_symbol:n { ##1 }
6589       \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
6590         \l_stex_get_symbol_uri_str
6591       }
6592     }
6593   }
6594   \ifvmode\noindent\fi
6595   \exp_args:Nnx
6596   \stex_annotate:nnn{paragraph}{\seq_use:Nn \l_tmpb_seq {,}}{
6597     \str_if_empty:NF \sparagraphtype {
6598       \stex_annotate_invisible:nnn{typestrings}{\sparagraphtype}{}}
6599   }
6600   \str_if_empty:NF \sparagraphfrom {
6601     \stex_annotate_invisible:nnn{from}{\sparagraphfrom}{}}
6602   }
6603   \str_if_empty:NF \sparagraphto {
6604     \stex_annotate_invisible:nnn{to}{\sparagraphto}{}}
6605   }
6606   \str_if_empty:NF \sparagraphname {
6607     \stex_suppress_html:n{\stex_symdecl_do:nn{}}{\sparagraphname}}
6608     \stex_annotate_invisible:nnn{statementname}{\sparagraphname}{}}
6609     \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sparagraphname}
6610   }
6611   \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\tl_to_str:n{symdoc}}{
6612     \clist_map_inline:Nn \l_tmpb_seq {
6613       \stex_ref_new_sym_target:n {##1}
6614     }
6615   }
6616   #2
6617 }
6618 }
6619 \endgroup
6620 \stex_smsmode_do:
6621 }
6622

```

(End definition for `\stexpatchparagraph`. This function is documented on page 55.)

```

6623 </package>

```

Chapter 35

The Implementation

```
6624 <*package>
6625 <@@=stex_sproof>
6626
6627 %%%%%%%%%%    sproof.dtx    %%%%%%%%%%
6628
```

35.1 Proofs

We first define some keys for the proof environment.

```
6629 \keys_define:nn { stex / spf } {
6630   id          .str_set_x:N = \spfid,
6631   for         .clist_set:N = \l__stex_sproof_spf_for_clist ,
6632   from        .tl_set:N    = \l__stex_sproof_spf_from_tl ,
6633   proofend    .tl_set:N    = \l__stex_sproof_spf_proofend_tl,
6634   type        .str_set_x:N = \spftype,
6635   title       .tl_set:N    = \spftitle,
6636   continues   .tl_set:N    = \l__stex_sproof_spf_continues_tl,
6637   functions   .tl_set:N    = \l__stex_sproof_spf_functions_tl,
6638   term        .tl_set:N    = \l__stex_sproof_spf_term_tl,
6639   method      .tl_set:N    = \l__stex_sproof_spf_method_tl,
6640   hide        .bool_set:N  = \l__stex_sproof_spf_hide_bool
6641 }
6642 \cs_new_protected:Nn \l__stex_sproof_spf_args:n {
6643   \str_clear:N \spfid
6644   \tl_clear:N \l__stex_sproof_spf_for_tl
6645   \tl_clear:N \l__stex_sproof_spf_from_tl
6646   \tl_set:Nn \l__stex_sproof_spf_proofend_tl {\sproof@box}
6647   \str_clear:N \spftype
6648   \tl_clear:N \spftitle
6649   \tl_clear:N \l__stex_sproof_spf_continues_tl
6650   \tl_clear:N \l__stex_sproof_spf_term_tl
6651   \tl_clear:N \l__stex_sproof_spf_functions_tl
6652   \tl_clear:N \l__stex_sproof_spf_method_tl
6653   \bool_set_false:N \l__stex_sproof_spf_hide_bool
6654   \keys_set:nn { stex / spf }{ #1 }
6655 }
6656 \bool_set_true:N \l__stex_sproof_inc_counter_bool
```

`\c__stex_sproof_flow_str` We define this macro, so that we can test whether the `display` key has the value `flow`

```
6657 \str_set:Nn\c__stex_sproof_flow_str{inline}
```

(End definition for `\c__stex_sproof_flow_str`.)

For proofs, we will have to have deeply nested structures of enumerated list-like environments. However, L^AT_EX only allows `enumerate` environments up to nesting depth 4 and general list environments up to listing depth 6. This is not enough for us. Therefore we have decided to go along the route proposed by Leslie Lamport to use a single top-level list with dotted sequences of numbers to identify the position in the proof tree. Unfortunately, we could not use his `pf.sty` package directly, since it does not do automatic numbering, and we have to add keyword arguments all over the place, to accomodate semantic information.

```
6658 \intarray_new:Nn\l__stex_sproof_counter_intarray{50}
6659 \cs_new_protected:Npn \sproofnumber {
6660   \int_set:Nn \l_tmpa_int {1}
6661   \bool_while_do:nn {
6662     \int_compare_p:nNn {
6663       \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int
6664     } > 0
6665   }{
6666     \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int .
6667     \int_incr:N \l_tmpa_int
6668   }
6669 }
6670 \cs_new_protected:Npn \__stex_sproof_inc_counter: {
6671   \int_set:Nn \l_tmpa_int {1}
6672   \bool_while_do:nn {
6673     \int_compare_p:nNn {
6674       \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int
6675     } > 0
6676   }{
6677     \int_incr:N \l_tmpa_int
6678   }
6679   \int_compare:nNnF \l_tmpa_int = 1 {
6680     \int_decr:N \l_tmpa_int
6681   }
6682   \intarray_gset:Nnn \l__stex_sproof_counter_intarray \l_tmpa_int {
6683     \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int + 1
6684   }
6685 }
6686
6687 \cs_new_protected:Npn \__stex_sproof_add_counter: {
6688   \int_set:Nn \l_tmpa_int {1}
6689   \bool_while_do:nn {
6690     \int_compare_p:nNn {
6691       \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int
6692     } > 0
6693   }{
6694     \int_incr:N \l_tmpa_int
6695   }
6696   \intarray_gset:Nnn \l__stex_sproof_counter_intarray \l_tmpa_int { 1 }
6697 }
6698
```



```

6699 \cs_new_protected:Npn \__stex_sproof_remove_counter: {
6700   \int_set:Nn \l_tmpa_int {1}
6701   \bool_while_do:nn {
6702     \int_compare_p:nNn {
6703       \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int
6704     } > 0
6705   }{
6706     \int_incr:N \l_tmpa_int
6707   }
6708   \int_decr:N \l_tmpa_int
6709   \intarray_gset:Nnn \l__stex_sproof_counter_intarray \l_tmpa_int { 0 }
6710 }

```

\sproofend This macro places a little box at the end of the line if there is space, or at the end of the next line if there isn't

```

6711 \def\sproof@box{
6712   \ltx@ifpackageloaded{amssymb}{\square$}{
6713     \hbox{\vrule\vbox{\hrule width 6 pt\vskip 6pt\hrule}\vrule}
6714   }
6715 }
6716 \def\sproofend{
6717   \tl_if_empty:NF \l__stex_sproof_spf_proofend_tl {
6718     \hfil\hfill\nobreak\hfill\l__stex_sproof_spf_proofend_tl\par\smallskip
6719   }
6720 }

```

(End definition for \sproofend. This function is documented on page 55.)

spf@*kw

```

6721 \def\spf@proofsketch@kw{Proof~Sketch}
6722 \def\spf@proof@kw{Proof}
6723 \def\spf@step@kw{Step}

```

(End definition for spf@*kw. This function is documented on page ??.)

For the other languages, we set up triggers

```

6724 \AddToHook{begindocument}{
6725   \ltx@ifpackageloaded{babel}{
6726     \makeatletter
6727     \clist_set:Nx \l_tmpa_clist {\bbl@loaded}
6728     \clist_if_in:NnT \l_tmpa_clist {ngerman}{
6729       \input{sproof-ngerman.ldf}
6730     }
6731     \clist_if_in:NnT \l_tmpa_clist {finnish}{
6732       \input{sproof-finnish.ldf}
6733     }
6734     \clist_if_in:NnT \l_tmpa_clist {french}{
6735       \input{sproof-french.ldf}
6736     }
6737     \clist_if_in:NnT \l_tmpa_clist {russian}{
6738       \input{sproof-russian.ldf}
6739     }
6740     \makeatother
6741   }{}
6742 }

```

spfsketch

```

6743 \newcommand\spfsketch[2] [] {
6744   \begin{group}
6745   \let \premise \stex_proof_premise:
6746   \stex_sproof_spf_args:n{#1}
6747   \stex_if_smsmode:TF {
6748     \str_if_empty:NF \spfid {
6749       \stex_ref_new_doc_target:n \spfid
6750     }
6751   }{
6752     \seq_clear:N \l_tmpa_seq
6753     \clist_map_inline:Nn \l__stex_sproof_spf_for_clist {
6754       \tl_if_empty:nF{ ##1 }{
6755         \stex_get_symbol:n { ##1 }
6756         \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
6757           \l_stex_get_symbol_uri_str
6758         }
6759       }
6760     }
6761     \exp_args:Nnx
6762     \stex_annotate:nnn{proofsketch}{\seq_use:Nn \l_tmpa_seq {},,}{
6763       \str_if_empty:NF \spftype {
6764         \stex_annotate_invisible:nnn{type}{\spftype}{
6765         }
6766       }
6767       \clist_set:Nn \l_tmpa_clist \spftype
6768       \tl_set:Nn \l_tmpa_tl {
6769         \titleemph{
6770           \tl_if_empty:NTF \spftitle {
6771             \spf@proofsketch@kw
6772           }{
6773             \spftitle
6774           }
6775         }
6776       }
6777       \clist_map_inline:Nn \l_tmpa_clist {
6778         \exp_args:Nn \str_if_eq:nnT \c__stex_sproof_flow_str {##1} {
6779           \tl_clear:N \l_tmpa_tl
6780         }
6781       }
6782       \str_if_empty:NF \spfid {
6783         \stex_ref_new_doc_target:n \spfid
6784       }
6785       \l_tmpa_tl #2 \sproofend
6786     }
6787   }
6788   \endgroup
6789   \stex_smsmode_do:
6790 }

```

(End definition for *spfsketch*. This function is documented on page 54.)

```

\__stex_sproof_maybe_comment:
\__stex_sproof_maybe_comment_end:
\__stex_sproof_start_comment:
6791 \bool_set_false:N \l__stex_sproof_in_spfblock_bool

```

```

6792
6793 \cs_new_protected:Nn \__stex_sproof_maybe_comment: {
6794   \bool_if:NF \l__stex_sproof_in_spfblock_bool {
6795     \par \setbox \l_tmpa_box \vbox \bgroup \everypar{\__stex_sproof_start_comment:}
6796   }
6797 }
6798 \cs_new_protected:Nn \__stex_sproof_maybe_comment_end: {
6799   \bool_if:NF \l__stex_sproof_in_spfblock_bool { \egroup }
6800 }
6801 \cs_new_protected:Nn \__stex_sproof_start_comment: {
6802   \csname @ @ par\endcsname\egroup\item[]\bgroup\stexcommentfont
6803 }
6804

```

(End definition for __stex_sproof_maybe_comment:, __stex_sproof_maybe_comment_end:, and __stex_sproof_start_comment:.)

\stexcommentfont

```

6805 \cs_new_protected:Npn \stexcommentfont {
6806   \small\itshape
6807 }

```

(End definition for \stexcommentfont. This function is documented on page ??.)

sproof (env.) In this environment, we initialize the proof depth counter \count10 to 10, and set up the description environment that will take the proof steps. At the end of the proof, we position the proof end into the last line.

```

6808 \cs_new_protected:Nn \__stex_sproof_start_env:nnn {
6809   \seq_clear:N \l_tmpa_seq
6810   \clist_map_inline:Nn \l__stex_sproof_spf_for_clist {
6811     \tl_if_empty:NF{ ##1 }{
6812       \stex_get_symbol:n { ##1 }
6813       \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
6814         \l_stex_get_symbol_uri_str
6815       }
6816     }
6817   }
6818   \exp_args:Nnnx
6819   \begin{stex_annotate_env}{#1}{\seq_use:Nn \l_tmpa_seq {,}}
6820   \str_if_empty:NF \spftype {
6821     \stex_annotate_invisible:nnn{type}{\spftype}{}
6822   }
6823   #3 {\~\stex_annotate:nnn{spftitle}{}{#2}}
6824   \str_if_empty:NF \spfid {
6825     \stex_ref_new_doc_target:n \spfid
6826   }
6827   \begin{stex_annotate_env}{spfbody}{\bool_if:NTF \l__stex_sproof_spf_hide_bool {false}{true}
6828   \bool_if:NT \l__stex_sproof_spf_hide_bool{
6829     \stex_html_backend:F{\setbox\l_tmpa_box\vbox\bgroup}
6830   }
6831   \begin{list}{}{
6832     \setlength\topsep{0pt}
6833     \setlength\parsep{0pt}
6834     \setlength\rightmargin{0pt}

```

```

6835 } \_stex_sproof_maybe_comment:
6836 }
6837 }
6838 \cs_new_protected:Nn \_stex_sproof_end_env:n {
6839   \stex_if_smsmode:F{
6840     \_stex_sproof_maybe_comment_end:
6841     \end{list}
6842     \bool_if:NT \l__stex_sproof_spf_hide_bool{
6843       \stex_html_backend:F{\egroup}
6844     }
6845     \clist_set:No \l_tmpa_clist \spftype
6846     #1
6847     \end{stex_annotate_env}
6848     \end{stex_annotate_env}
6849   }
6850 }
6851 \NewDocumentEnvironment{sproof}{s O{} m}{
6852   \intarray_gzero:N \l__stex_sproof_counter_intarray
6853   \intarray_gset:Nnn \l__stex_sproof_counter_intarray 1 1
6854   \stex_reactivate_macro:N \yield
6855   \stex_reactivate_macro:N \eqstep
6856   \stex_reactivate_macro:N \assumption
6857   \stex_reactivate_macro:N \conclude
6858   \stex_reactivate_macro:N \spfstep
6859   \_stex_sproof_spf_args:n{#2}
6860   \stex_if_smsmode:TF {
6861     \str_if_empty:NF \spfid {
6862       \stex_ref_new_doc_target:n \spfid
6863     }
6864   }{
6865     \_stex_sproof_start_env:nnn{sproof}{#3}{
6866       \clist_set:No \l_tmpa_clist \spftype
6867       \tl_clear:N \l_tmpa_tl
6868       \clist_map_inline:Nn \l_tmpa_clist {
6869         \tl_if_exist:cT {\_stex_sproof_sproof_##1_start:}{
6870           \tl_set:Nn \l_tmpa_tl {\use:c{\_stex_sproof_sproof_##1_start:}}
6871         }
6872         \exp_args:No \str_if_eq:nnT \c__stex_sproof_flow_str {##1} {
6873           \tl_set:Nn \l_tmpa_tl {\use:n{}}
6874         }
6875       }
6876       \tl_if_empty:NTF \l_tmpa_tl {
6877         \_stex_sproof_sproof_start:
6878       }{
6879         \l_tmpa_tl
6880       }
6881     }
6882   }
6883   \stex_smsmode_do:
6884 }{\_stex_sproof_end_env:n{
6885   \tl_clear:N \l_tmpa_tl
6886   \clist_map_inline:Nn \l_tmpa_clist {
6887     \tl_if_exist:cT {\_stex_sproof_sproof_##1_end:}{
6888       \tl_set:Nn \l_tmpa_tl {\use:c{\_stex_sproof_sproof_##1_end:}}

```

```

6889     }
6890   }
6891   \tl_if_empty:NTF \l_tmpa_tl {
6892     \__stex_sproof_sproof_end:
6893   }{
6894     \l_tmpa_tl
6895   }
6896 }
6897 \NewDocumentEnvironment{subproof}{s O{} m}{
6898   \__stex_sproof_spf_args:n{#2}
6899   \stex_if_smsmode:TF {
6900     \str_if_empty:NF \spfid {
6901       \stex_ref_new_doc_target:n \spfid
6902     }
6903   }{
6904     \__stex_sproof_start_env:nnn{subproof}{\item[\sproofnumber]\ignorespacesandpars #3}{ }
6905   }
6906   \__stex_sproof_add_counter:
6907   \stex_smsmode_do:
6908 }{\__stex_sproof_remove_counter:\__stex_sproof_end_env:n{ }
6909   \bool_if:NT \l__stex_sproof_inc_counter_bool {
6910     \__stex_sproof_inc_counter:
6911   }
6912   \aftergroup\__stex_sproof_maybe_comment:
6913 }
6914 \AddToHook{env/subproof/before}{\__stex_sproof_maybe_comment_end:}
6915
6916 \cs_new_protected:Nn \__stex_sproof_sproof_start: {
6917   \par\noindent\titllemph{
6918     \tl_if_empty:NTF \spftype {
6919       \spf@proof@kw
6920     }{
6921       \spftype
6922     }
6923   }:
6924 }
6925 \cs_new_protected:Nn \__stex_sproof_sproof_end: {\sproofend}
6926
6927 \newcommand\stexpatchproof[3] [] {
6928   \str_set:Nx \l_tmpa_str{ #1 }
6929   \str_if_empty:NTF \l_tmpa_str {
6930     \tl_set:Nn \__stex_sproof_sproof_start: { #2 }
6931     \tl_set:Nn \__stex_sproof_sproof_end: { #3 }
6932   }{
6933     \exp_after:wN \tl_set:Nn \csname __stex_sproof_sproof_#1_start:\endcsname{ #2 }
6934     \exp_after:wN \tl_set:Nn \csname __stex_sproof_sproof_#1_end:\endcsname{ #3 }
6935   }
6936 }

```

\pstep
 \conclude
 \assumption
 \have
 \eqstep

```

6937
6938 \keys_define:nn { stex / spfsteps } {
6939   id          .str_set_x:N = \spfstepid,
6940   for         .clist_set:N = \l__stex_sproof_spf_for_clist ,

```

```

6941 type .str_set_x:N = \spftype,
6942 title .tl_set:N = \spftitle,
6943 method .tl_set:N = \l__stex_sproof_spf_method_tl,
6944 term .tl_set:N = \l__stex_sproof_spf_term_tl
6945 }
6946 \cs_new_protected:Nn \__stex_sproof_spfstep_args:n {
6947 \str_clear:N \spfstepid
6948 \clist_clear:N \l__stex_sproof_spf_for_clist
6949 \str_clear:N \spftype
6950 \tl_clear:N \l__stex_sproof_spf_method_tl
6951 \tl_clear:N \l__stex_sproof_spf_term_tl
6952 %\bool_set_false:N \l__stex_sproof_inc_counter_bool
6953 \keys_set:nn { stex / spfsteps }{ #1 }
6954 }
6955
6956 \cs_new_protected:Nn \__stex_sproof_make_step_macro:Nnnnn {
6957 \NewDocumentCommand #1 {s O{} +m} {
6958 \__stex_sproof_maybe_comment_end:
6959
6960 \__stex_sproof_spfstep_args:n{##2}
6961 \stex_annotate:nnn{spfstep}{#2}{
6962 \tl_if_empty:NF \l__stex_sproof_spf_term_tl {
6963 \stex_annotate_invisible:nnn{spfyield}{}{\l__stex_sproof_spf_term_tl$}
6964 }
6965 \bool_if:NTF \l__stex_sproof_in_spfblock_bool {
6966 #4
6967 }{
6968 \item[\IfBooleanTF ##1 {}{#3}]
6969 }
6970 \ignorespacesandpars ##3
6971 }
6972 \bool_if:NF \l__stex_sproof_in_spfblock_bool { \IfBooleanTF ##1 {}{ #5 } }
6973 \__stex_sproof_maybe_comment:
6974 }
6975 \stex_deactivate_macro:Nn #1 {sproof~environments}
6976 }
6977
6978 \__stex_sproof_make_step_macro:Nnnnn \assumption {assumption} \sproofnumber {} \__stex_sproof
6979 \__stex_sproof_make_step_macro:Nnnnn \conclude {conclusion} {\$ \Rightarrow$} {} {}
6980 \__stex_sproof_make_step_macro:Nnnnn \spfstep {} \sproofnumber {} \__stex_sproof_inc_counter
6981
6982 \NewDocumentCommand \eqstep {s m}{
6983 \__stex_sproof_maybe_comment_end:
6984 \bool_if:NTF \l__stex_sproof_in_spfblock_bool {
6985 $=$
6986 }{
6987 \item[$=$]
6988 }
6989 $\stex_annotate:nnn{spfstep}{eq}{ #2 }$
6990 \__stex_sproof_maybe_comment:
6991 }
6992 \stex_deactivate_macro:Nn \eqstep {sproof~environments}
6993
6994 \NewDocumentCommand \yield {+m}{

```

```

6995 \stex_annotate:nnn{spfyield}{\}{ #1 }
6996 }
6997 \stex_deactivate_macro:Nn \yield {sproof~environments}
6998
6999 \NewDocumentEnvironment{spfblock}{\}{
7000 \item[]
7001 \bool_set_true:N \l__stex_sproof_in_spfblock_bool
7002 }{
7003 \aftergroup\__stex_sproof_maybe_comment:
7004 }
7005 \AddToHook{env/spfblock/before}{\__stex_sproof_maybe_comment_end:}
7006

```

(End definition for `\pstep` and others. These functions are documented on page ??.)

`\spfidea`

```

7007 \NewDocumentCommand\spfidea{0{} +m}{
7008 \__stex_sproof_spf_args:n{#1}
7009 \titleemph{
7010 \tl_if_empty:NTF \spftype {Proof~Idea}{
7011 \spftype
7012 }:
7013 }~#2
7014 \sproofend
7015 }

```

(End definition for `\spfidea`. This function is documented on page 54.)

```

7016 \newcommand\spfjust[1]{
7017 #1
7018 }
7019 \</package>

```

Some auxiliary code, and clean up to be executed at the end of the package.

Chapter 36

STEX -Others Implementation

```
7020 <*package>
7021
7022 %%%%%%%%%% others.dtx %%%%%%%%%%
7023
7024 <@@=stex_others>
    Warnings and error messages
7025 % None

\MSC Math subject classifier

7026 \NewDocumentCommand \MSC {m} {
7027 % TODO
7028 }

(End definition for \MSC. This function is documented on page ??.)
    Patching tikzinput, if loaded

7029 \@ifpackageloaded{tikzinput}{
7030 \RequirePackage{stex-tikzinput}
7031 }{}
7032
7033 \bool_if:NT \c_stex_persist_mode_bool {
7034 \let__stex_notation_restore_notation_old:nnnnn
7035 \__stex_notation_restore_notation:nnnnn
7036 \def__stex_notation_restore_notation_new:nnnnn#1#2#3#4#5{
7037 \__stex_notation_restore_notation_old:nnnnn{#1}{#2}{#3}{#4}{#5}
7038 \ExplSyntaxOn
7039 }
7040 \def__stex_notation_restore_notation:nnnnn{
7041 \ExplSyntaxOff
7042 \catcode'\sim10
7043 \__stex_notation_restore_notation_new:nnnnn
7044 }
7045 \input{\jobname.sms}
7046 \let__stex_notation_restore_notation:nnnnn
7047 \__stex_notation_restore_notation_old:nnnnn
7048 \prop_if_exist:NT\c_stex_mathhub_main_manifest_prop{
```



```

7049     \prop_get:NnN \c_stex_mathhub_main_manifest_prop {id}
7050     \l_tmpa_str
7051     \prop_set_eq:cN { c_stex_mathhub_\l_tmpa_str_manifest_prop }
7052     \c_stex_mathhub_main_manifest_prop
7053     \exp_args:Nx \stex_set_current_repository:n { \l_tmpa_str }
7054   }
7055 }
7056
7057 \stex_get_document_uri:
7058 </package>

```

Chapter 37

STEX -Metatheory Implementation

```
7059 <*package>
7060 <@@=stex_modules>
7061
7062 %%%%%%%%%%% metatheory.dtx %%%%%%%%%%%
7063
7064 \str_const:Nn \c_stex_metatheory_ns_str {http://mathhub.info/sTeX/meta}
7065 \begingroup
7066 \stex_module_setup:nn{
7067   ns=\c_stex_metatheory_ns_str,
7068   meta=NONE
7069 }{Metatheory}
7070 \stex_reactivate_macro:N \symdecl
7071 \stex_reactivate_macro:N \notation
7072 \stex_reactivate_macro:N \symdef
7073 \ExplSyntaxOff
7074 \csname stex_suppress_html:n\endcsname{
7075   % is-a (a:A, a \in A, a is an A, etc.)
7076   \symdecl{isa}[args=ai]
7077   \notation{isa}[typed,op=:]{#1 \comp{:} #2}{##1 \comp, ##2}
7078   \notation{isa}[in]{#1 \comp\in #2}{##1 \comp, ##2}
7079   \notation{isa}[pred]{#2\comp(#1 \comp)}{##1 \comp, ##2}
7080
7081   % bind (\forall, \Pi, \lambda etc.)
7082   \symdecl{bind}[args=Bi,assoc=pre]
7083   \notation{bind}[depfun,prec=nobrackets,op={(\cdot)\;\to\;\cdot}]{\comp( #1 \comp{}\;\to\;)}
7084   \notation{bind}[forall]{\comp\forall #1.\;#2}{##1 \comp, ##2}
7085   \notation{bind}[Pi]{\comp\prod_{#1}#2}{##1 \comp, ##2}
7086
7087   % implicit bind
7088   \symdecl{implicitbind}[args=Bi,assoc=pre]
7089   \notation{implicitbind}[braces,prec=nobrackets,op={(\cdot\_I\;\cdot)}]{\comp\{ #1 \comp{
7090     \notation{implicitbind}[depfun,prec=nobrackets]{\comp( #1 \comp{}\;\to\_I\; } #2}{##1 \comp,
7091     \notation{implicitbind}[Pi]{\comp\prod^I_{#1}#2}{##1\comp,##2}
7092
7093   % dummy variable
```

```

7094 \symdecl{dummyvar}
7095 \notation{dummyvar}[underscore]{\comp\_}
7096 \notation{dummyvar}[dot]{\comp\cdot}
7097 \notation{dummyvar}[dash]{\comp{\rm --}}
7098
7099 %fromto (function space, Hom-set, implication etc.)
7100 \symdecl{fromto}[args=ai]
7101 \notation{fromto}[xarrow]{#1 \comp\to #2}{##1 \comp\times ##2}
7102 \notation{fromto}[arrow]{#1 \comp\to #2}{##1 \comp\to ##2}
7103
7104 % mapto (lambda etc.)
7105 \symdecl{mapto}[args=Bi]
7106 %\notation{mapto}[mapsto]{#1 \comp\mapsto #2}{#1 \comp, #2}
7107 %\notation{mapto}[lambda]{\comp\lambda #1 \comp.\; #2}{#1 \comp, #2}
7108 %\notation{mapto}[lambdau]{\comp\lambda_{#1} \comp.\; #2}{#1 \comp, #2}
7109
7110 % function/operator application
7111 \symdecl{apply}[args=ia]
7112 \notation{apply}[prec=0;0x\infpres,parens,op=\cdot(\cdot)]{#1 \comp( #2 \comp)}{##1 \comp,
7113 \notation{apply}[prec=0;0x\infpres,lambda]{#1 \; #2 }{##1 \; ; ##2}
7114
7115 % collection of propositions/booleans/truth values
7116 \symdecl{prop}[name=proposition]
7117 \notation{prop}[prop]{\comp{\rm prop}}
7118 \notation{prop}[BOOL]{\comp{\rm BOOL}}
7119
7120 \symdecl{judgmentholds}[args=1]
7121 \notation{judgmentholds}[vdash,op=\vdash]{\comp\vdash\; #1}
7122
7123 % sequences
7124 \symdecl{seqtype}[args=1]
7125 \notation{seqtype}[kleene]{#1^{\comp\ast}}
7126
7127 \symdecl{seqexpr}[args=a]
7128 \notation{seqexpr}[angle,prec=nobrackets]{\comp\langle #1\comp\rangle}{##1\comp,##2}
7129
7130 \symdef{seqmap}[args=abi,setlike]{\comp\{#3 \comp| #2\comp\in \dobrackets{#1} \comp\}}{##1
7131 \symdef{seqprepend}[args=ia]{#1 \comp{::} #2}{##1 \comp, ##2}
7132 \symdef{seqappend}[args=ai]{#1 \comp{::} #2}{##1 \comp, ##2}
7133 \symdef{seqfoldleft}[args=iabbi]{ \comp{foldl}\dobrackets{#1,#2}\dobrackets{#3\comp,#4\comp}
7134 \symdef{seqfoldright}[args=iabbi,op=foldr]{ \comp{foldr}\dobrackets{#1,#2}\dobrackets{#3\comp
7135 \symdef{seqhead}[args=a]{\comp{head}\dobrackets{#1}}{##1 \comp, ##2}
7136 \symdef{seqtail}[args=a]{\comp{tail}\dobrackets{#1}}{##1 \comp, ##2}
7137 \symdef{seqlast}[args=a]{\comp{last}\dobrackets{#1}}{##1 \comp, ##2}
7138 \symdef{seqinit}[args=a]{\comp{tail}\dobrackets{#1}}{##1 \comp, ##2}
7139
7140 \symdef{sequence-index}[args=2,li,prec=nobrackets]{#{#1}_{#2}}
7141 \notation{sequence-index}[ui,prec=nobrackets]{#{#1}~{#2}}
7142
7143 \symdef{aseqdots}[args=a,prec=nobrackets]{#1\comp{,\ellipses}}{##1\comp,##2}
7144 \symdef{aseqfromto}[args=ai,prec=nobrackets]{#1\comp{,\ellipses,}#2}{##1\comp,##2}
7145 \symdef{aseqfromtovia}[args=aii,prec=nobrackets]{#1\comp{,\ellipses,}#2\comp{,\ellipses,}#
7146
7147 % nat literals

```

```

7148 \symdef{natliteral}{\comp{\mathtt{Ord}}}
7149
7150 % letin (''let'', local definitions, variable substitution)
7151 \symdecl{letin}[args=bii]
7152 \notation{letin}{let}{\comp{\rm let}}\;#1\comp{=}\#2\;\comp{\rm in}}\;#3}
7153 \notation{letin}{subst}{#3 \comp[ #1 \comp/ #2 \comp]}
7154 \notation{letin}{frac}{#3 \comp[ \frac{#2}{#1} \comp]}
7155
7156 % structures
7157 \symdecl*{module-type}[args=1]
7158 \notation{module-type}{\comp{\mathtt{MOD}}} #1}
7159 \symdecl{mathstruct}[name=mathematical-structure,args=a] % TODO
7160 \notation{mathstruct}[angle,prec=nobrackets]{\comp\angle #1 \comp\rangle}{##1 \comp, ##2}
7161
7162 % objects
7163 \symdecl{object}
7164 \notation{object}{\comp{\mathtt{OBJECT}}}
7165
7166 }
7167
7168 % The following are abbreviations in the sTeX corpus that are left over from earlier
7169 % developments. They will eventually be phased out.
7170
7171 \ExplSyntaxOn
7172 \stex_add_to_current_module:n{
7173   \def\nappli#1#2#3#4{\apply{#1}{\naseqli{#2}{#3}{#4}}}
7174   \def\nappui#1#2#3#4{\apply{#1}{\nasequi{#2}{#3}{#4}}}
7175   \def\livar{\csname sequence-index\endcsname[li]}
7176   \def\uivar{\csname sequence-index\endcsname[ui]}
7177   \def\naseqli#1#2#3{\aseqfromto{\livar{#1}{#2}}{\livar{#1}{#3}}}
7178   \def\nasequi#1#2#3{\aseqfromto{\uivar{#1}{#2}}{\uivar{#1}{#3}}}
7179 }
7180 \__stex_modules_end_module:
7181 \endgroup
7182
7183
7184 \str_set:Nn \l_stex_metatheory_str {http://mathhub.info/sTeX/meta?Metatheory}
7185
7186 \NewDocumentCommand \setmetatheory {0{} m}{
7187   \stex_import_module_uri:nn { #1 } { #2 }
7188   \stex_import_require_module:nnnn
7189   { \l_stex_import_ns_str } { \l_stex_import_archive_str }
7190   { \l_stex_import_path_str } { \l_stex_import_name_str }
7191   \str_set:Nx \l_stex_metatheory_str { \l_stex_import_ns_str ? \l_stex_import_name_str }
7192   \stex_smsmode_do:
7193 }
7194
7195 </package>

```

Chapter 38

Tikzinput Implementation

```
7196 <@@=tikzinput>
7197 <*package>
7198
7199 %%%%%%%%%% tikzinput.dtx %%%%%%%%%%
7200
7201 \ProvidesExplPackage{tikzinput}{2022/09/14}{3.2.0}{tikzinput package}
7202 \RequirePackage{l3keys2e}
7203
7204 \keys_define:nn { tikzinput } {
7205   image .bool_set:N = \c_tikzinput_image_bool,
7206   image .default:n = false ,
7207   unknown .code:n = {}
7208 }
7209
7210 \ProcessKeysOptions { tikzinput }
7211
7212 \bool_if:NTF \c_tikzinput_image_bool {
7213   \RequirePackage{graphicx}
7214
7215   \providecommand\usetikzlibrary[]{}
7216   \newcommand\tikzinput[2] [] {\includegraphics[#1]{#2}}
7217 }{
7218   \RequirePackage{tikz}
7219   \RequirePackage{standalone}
7220
7221   \newcommand \tikzinput [2] [] {
7222     \setkeys{Gin}{#1}
7223     \ifx \Gin@ewidth \Gin@exclamation
7224       \ifx \Gin@eheight \Gin@exclamation
7225         \input { #2 }
7226       \else
7227         \resizebox{!}{ \Gin@eheight }{
7228           \input { #2 }
7229         }
7230       \fi
7231     \else
7232       \ifx \Gin@eheight \Gin@exclamation
7233         \resizebox{ \Gin@ewidth }{!}{
```

```

7234         \input { #2 }
7235     }
7236     \else
7237         \resizebox{ \Gin@ewidth }{ \Gin@eheight }{
7238             \input { #2 }
7239         }
7240     \fi
7241 \fi
7242 }
7243 }
7244
7245 \newcommand \ctikzinput [2] [] {
7246     \begin{center}
7247         \tikzinput [#1] {#2}
7248     \end{center}
7249 }
7250
7251 \@ifpackageloaded{stex}{
7252     \RequirePackage{stex-tikzinput}
7253 }{}
7254
7255 </package>
7256 <*stex>
7257
7258 \ProvidesExplPackage{stex-tikzinput}{2022/09/14}{3.2.0}{stex-tikzinput}
7259 \RequirePackage{stex}
7260 \RequirePackage{tikzinput}
7261
7262 \newcommand\mhtikzinput[2] []{%
7263     \def\Gin@mhrepos{ }\setkeys{Gin}{#1}%
7264     \stex_in_repository:nn\Gin@mhrepos{
7265         \tikzinput[#1]{\mhp\path{##1}{#2}}
7266     }
7267 }
7268
7269 \newcommand\cmhtikzinput[2] [] {\begin{center}\mhtikzinput[#1]{#2}\end{center}}
7270
7271 \cs_new_protected:Nn \__tikzinput_usetikzlibrary:nn {
7272     \pgfkeys@spdef\pgf@temp{#1}
7273     \expandafter\ifx\csname tikz@library@\pgf@temp @loaded\endcsname\relax%
7274     \expandafter\global\expandafter\let\csname tikz@library@\pgf@temp @loaded\endcsname=\pgf@temp
7275     \expandafter\edef\csname tikz@library@#1@atcode\endcsname{\the\catcode'\@}
7276     \expandafter\edef\csname tikz@library@#1@barcode\endcsname{\the\catcode'\|}
7277     \expandafter\edef\csname tikz@library@#1@dollarcode\endcsname{\the\catcode'\$}
7278     \catcode'\@=11
7279     \catcode'\|=12
7280     \catcode'\$=3
7281     \pgfutil@InputIfFileExists{#2}{-}{-}
7282     \catcode'\@=\csname tikz@library@#1@atcode\endcsname
7283     \catcode'\|=\csname tikz@library@#1@barcode\endcsname
7284     \catcode'\$=\csname tikz@library@#1@dollarcode\endcsname
7285 }
7286
7287 \newcommand\libusetikzlibrary[1]{

```

```

7287 \prop_if_exist:NF \l_stex_current_repository_prop {
7288   \msg_error:nnn{stex}{error/notinarchive}\libusetikzlibrary
7289 }
7290 \prop_get:NnNF \l_stex_current_repository_prop {id} \l_tmpa_str {
7291   \msg_error:nnn{stex}{error/notinarchive}\libusetikzlibrary
7292 }
7293 \seq_clear:N \l__tikzinput_libinput_files_seq
7294 \seq_set_eq:NN \l_tmpa_seq \c_stex_mathhub_seq
7295 \seq_set_split:NnV \l_tmpb_seq / \l_tmpa_str
7296
7297 \bool_while_do:nn { ! \seq_if_empty_p:N \l_tmpb_seq }{
7298   \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / meta-inf / lib / tikzlibrary
7299   \IfFileExists{ \l_tmpa_str }{
7300     \seq_put_right:No \l__tikzinput_libinput_files_seq \l_tmpa_str
7301   }{}
7302   \seq_pop_left:NN \l_tmpb_seq \l_tmpa_str
7303   \seq_put_right:No \l_tmpa_seq \l_tmpa_str
7304 }
7305
7306 \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / lib / tikzlibrary #1 .code.t
7307 \IfFileExists{ \l_tmpa_str }{
7308   \seq_put_right:No \l__tikzinput_libinput_files_seq \l_tmpa_str
7309 }{}
7310
7311 \seq_if_empty:NTF \l__tikzinput_libinput_files_seq {
7312   \msg_error:nxxx{stex}{error/nofile}{\exp_not:N\libusetikzlibrary}{tikzlibrary #1 .code.t
7313 }{
7314   \int_compare:nNnTF {\seq_count:N \l__tikzinput_libinput_files_seq} = 1 {
7315     \seq_map_inline:Nn \l__tikzinput_libinput_files_seq {
7316       \__tikzinput_usetikzlibrary:nn{#1}{ ##1 }
7317     }
7318   }{
7319     \msg_error:nxxx{stex}{error/twofiles}{\exp_not:N\libusetikzlibrary}{tikzlibrary #1 .co
7320   }
7321 }
7322 }
7323 </stex>

```

Chapter 39

document-structure.sty Implementation

```
7324 \*package>
7325 \@@=document_structure>
7326 \ProvidesExplPackage{document-structure}{2022/09/14}{3.2.0}{Modular Document Structure}
7327 \RequirePackage{13keys2e}
```

39.1 Package Options

We declare some switches which will modify the behavior according to the package options. Generally, an option xxx will just set the appropriate switches to true (otherwise they stay false).

```
7328
7329 \keys_define:nn{ document-structure }{
7330   class      .str_set_x:N = \c_document_structure_class_str,
7331   topsect    .str_set_x:N = \c_document_structure_topsect_str,
7332   unknown    .code:n      = {
7333     \PassOptionsToClass{\CurrentOption}{stex}
7334     \PassOptionsToClass{\CurrentOption}{tikzinput}
7335   }
7336   % showignores .bool_set:N = \c_document_structure_showignores_bool,
7337 }
7338 \ProcessKeysOptions{ document-structure }
7339 \str_if_empty:NT \c_document_structure_class_str {
7340   \str_set:Nn \c_document_structure_class_str {article}
7341 }
7342 \str_if_empty:NT \c_document_structure_topsect_str {
7343   \str_set:Nn \c_document_structure_topsect_str {section}
7344 }
```

Then we need to set up the packages by requiring the `sref` package to be loaded, and set up triggers for other languages

```
7345 \RequirePackage{xspace}
7346 \RequirePackage{comment}
7347 \RequirePackage{stex}
7348 \AddToHook{begindocument}{
```



```

7349 \ltx@ifpackageloaded{babel}{
7350     \clist_set:Nx \l_tmpa_clist {\bbl@loaded}
7351     \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\detokenize{ngerman}}{
7352         \makeatletter\input{document-structure-ngerman.ldf}\makeatother
7353     }
7354 }{}
7355 }

```

`\section@level` Finally, we set the `\section@level` macro that governs sectioning. The default is two (corresponding to the `article` class), then we set the defaults for the standard classes `book` and `report` and then we take care of the levels passed in via the `topsect` option.

```

7356 \int_new:N \l_document_structure_section_level_int
7357 \str_case:NnF \c_document_structure_topsect_str {
7358     {part}}{
7359     \int_set:Nn \l_document_structure_section_level_int {0}
7360 }
7361 {chapter}}{
7362     \int_set:Nn \l_document_structure_section_level_int {1}
7363 }
7364 }{
7365     \str_case:NnF \c_document_structure_class_str {
7366         {book}}{
7367             \int_set:Nn \l_document_structure_section_level_int {0}
7368         }
7369         {report}}{
7370             \int_set:Nn \l_document_structure_section_level_int {0}
7371         }
7372     }{
7373         \int_set:Nn \l_document_structure_section_level_int {2}
7374     }
7375 }

```

39.2 Document Structure

The structure of the document is given by the `sfragment` environment. The hierarchy is adjusted automatically according to the L^AT_EX class in effect.

`\currentsectionlevel` For the `\currentsectionlevel` and `\Currentsectionlevel` macros we use an internal macro `\current@section@level` that only contains the keyword (no markup). We initialize it with “document” as a default. In the generated OMDoc, we only generate a text element of class `omdoc_currentsectionlevel`, which will be instantiated by CSS later.⁹

EdN:9

```

7376 \def\current@section@level{document}%
7377 \newcommand\currentsectionlevel{\lowercase\expandafter{\current@section@level}\xspace}%
7378 \newcommand\Currentsectionlevel{\expandafter\MakeUppercase\current@section@level\xspace}%

```

(End definition for `\currentsectionlevel`. This function is documented on page 62.)

`\skipfragment`

```

7379 \cs_new_protected:Npn \skipfragment {

```

⁹EdNOTE: MK: we may have to experiment with the more powerful uppercasing macro from `mfirstuc.sty` once we internationalize.

```

7380 \ifcase\l_document_structure_section_level_int
7381 \or\stepcounter{part}
7382 \or\stepcounter{chapter}
7383 \or\stepcounter{section}
7384 \or\stepcounter{subsection}
7385 \or\stepcounter{subsubsection}
7386 \or\stepcounter{paragraph}
7387 \or\stepcounter{subparagraph}
7388 \fi
7389 }

```

(End definition for `\skipfragment`. This function is documented on page 61.)

`blindfragment (env.)`

```

7390 \newcommand\at@begin@blindsfragment[1]{
7391 \newenvironment{blindfragment}
7392 {
7393 \int_incr:N\l_document_structure_section_level_int
7394 \at@begin@blindsfragment\l_document_structure_section_level_int
7395 }{}

```

`\sfragment@nonum` convenience macro: `\sfragment@nonum{<level>}{<title>}` makes an unnumbered sectioning with title `<title>` at level `<level>`.

```

7396 \newcommand\sfragment@nonum[2]{
7397 \ifx\hyper@anchor\@undefined\else\phantomsection\fi
7398 \addcontentsline{toc}{#1}{#2}\@nameuse{#1}*{#2}
7399 }

```

(End definition for `\sfragment@nonum`. This function is documented on page ??.)

`\sfragment@num` convenience macro: `\sfragment@num{<level>}{<title>}` makes numbered sectioning with title `<title>` at level `<level>`. We have to check the `short` key was given in the `sfragment` environment and – if it is use it. But how to do that depends on whether the `rdfmata` package has been loaded. In the end we call `\sref@label@id` to enable crossreferencing.

```

7400 \newcommand\sfragment@num[2]{
7401 \tl_if_empty:NTF \l__document_structure_sfragment_short_tl {
7402 \@nameuse{#1}{#2}
7403 }{
7404 \cs_if_exist:NTF\rdfmata@sectioning{
7405 \@nameuse{rdfmata@#1@old}[\l__document_structure_sfragment_short_tl]{#2}
7406 }{
7407 \@nameuse{#1}[\l__document_structure_sfragment_short_tl]{#2}
7408 }
7409 }
7410 %\sref@label@id@arg{\omdoc@sect@name~\@nameuse{the#1}}\sfragment@id
7411 }

```

(End definition for `\sfragment@num`. This function is documented on page ??.)

`sfragment (env.)`

```

7412 \keys_define:nn { document-structure / sfragment }{
7413 id .str_set_x:N = \l__document_structure_sfragment_id_str,
7414 date .str_set_x:N = \l__document_structure_sfragment_date_str,

```

```

7415 creators      .clist_set:N = \l__document_structure_sfragment_creators_clist,
7416 contributors  .clist_set:N = \l__document_structure_sfragment_contributors_clist,
7417 srccite       .tl_set:N     = \l__document_structure_sfragment_srccite_tl,
7418 type          .tl_set:N     = \l__document_structure_sfragment_type_tl,
7419 short         .tl_set:N     = \l__document_structure_sfragment_short_tl,
7420 intro         .tl_set:N     = \l__document_structure_sfragment_intro_tl,
7421 imports       .tl_set:N     = \l__document_structure_sfragment_imports_tl,
7422 loadmodules   .bool_set:N   = \l__document_structure_sfragment_loadmodules_bool
7423 }
7424 \cs_new_protected:Nn \l__document_structure_sfragment_args:n {
7425   \str_clear:N \l__document_structure_sfragment_id_str
7426   \str_clear:N \l__document_structure_sfragment_date_str
7427   \clist_clear:N \l__document_structure_sfragment_creators_clist
7428   \clist_clear:N \l__document_structure_sfragment_contributors_clist
7429   \tl_clear:N \l__document_structure_sfragment_srccite_tl
7430   \tl_clear:N \l__document_structure_sfragment_type_tl
7431   \tl_clear:N \l__document_structure_sfragment_short_tl
7432   \tl_clear:N \l__document_structure_sfragment_imports_tl
7433   \tl_clear:N \l__document_structure_sfragment_intro_tl
7434   \bool_set_false:N \l__document_structure_sfragment_loadmodules_bool
7435   \keys_set:nn { document-structure / sfragment } { #1 }
7436 }

```

we define a switch for numbering lines and a hook for the beginning of groups: The `\at@begin@sfragment` macro allows customization. It is run at the beginning of the `sfragment`, i.e. after the section heading.

```

7437 \newif\if@mainmatter\@mainmattertrue
7438 \newcommand\at@begin@sfragment[3][]{ }

```

Then we define a helper macro that takes care of the sectioning magic. It comes with its own key/value interface for customization.

```

7439 \keys_define:nn { document-structure / sectioning }{
7440   name      .str_set_x:N = \l__document_structure_sect_name_str  ,
7441   ref       .str_set_x:N = \l__document_structure_sect_ref_str   ,
7442   clear     .bool_set:N  = \l__document_structure_sect_clear_bool ,
7443   clear     .default:n   = {true}                                ,
7444   num       .bool_set:N  = \l__document_structure_sect_num_bool  ,
7445   num       .default:n   = {true}
7446 }
7447 \cs_new_protected:Nn \l__document_structure_sect_args:n {
7448   \str_clear:N \l__document_structure_sect_name_str
7449   \str_clear:N \l__document_structure_sect_ref_str
7450   \bool_set_false:N \l__document_structure_sect_clear_bool
7451   \bool_set_false:N \l__document_structure_sect_num_bool
7452   \keys_set:nn { document-structure / sectioning } { #1 }
7453 }
7454 \newcommand\omdoc@sectioning[3][]{
7455   \l__document_structure_sect_args:n {#1 }
7456   \let\omdoc@sect@name\l__document_structure_sect_name_str
7457   \bool_if:NT \l__document_structure_sect_clear_bool { \cleardoublepage }
7458   \if@mainmatter% numbering not overridden by frontmatter, etc.
7459     \bool_if:NTF \l__document_structure_sect_num_bool {
7460       \sfragment@num{#2}{#3}
7461     }{

```

```

7462     \sfragment@nonum{#2}{#3}
7463   }
7464   \def\current@section@level{\omdoc@sect@name}
7465   \else
7466     \sfragment@nonum{#2}{#3}
7467   \fi
7468 }% if@mainmatter

```

and another one, if redefines the `\addtocontentsline` macro of L^AT_EX to import the respective macros. It takes as an argument a list of module names.

```

7469 \newcommand\sfragment@redefine@addtocontents[1]{%
7470 %\edef\__document_structureimport{#1}%
7471 %\@for\@I:=\__document_structureimport\do{%
7472 %\edef\@path{\csname module@\@I @path\endcsname}%
7473 %\@ifundefined{tf@toc}\relax%
7474 %    {\protected@write\tf@toc}{\string\@requiremodules{\@path}}}%
7475 %\ifx\hyper@anchor\@undefined% hyperref.sty loaded?
7476 %\def\addcontentsline##1##2##3{%
7477 %\addtocontents{##1}{\protect\contentsline{##2}{\string\withusedmodules{#1}{##3}}{\thepage}}%
7478 %\else% hyperref.sty not loaded
7479 %\def\addcontentsline##1##2##3{%
7480 %\addtocontents{##1}{\protect\contentsline{##2}{\string\withusedmodules{#1}{##3}}{\thepage}}%
7481 %\fi
7482 }% hypreref.sty loaded?

```

now the `sfragment` environment itself. This takes care of the table of contents via the helper macro above and then selects the appropriate sectioning command from `article.cls`. It also registers the current level of sfragments in the `\sfragment@level` counter.

```

7483 \newenvironment{sfragment}[2][ ]% keys, title
7484 {
7485   \__document_structure_sfragment_args:n { #1 }\sref@target%

```

If the `loadmodules` key is set on `\begin{sfragment}`, we redefine the `\addcontetsline` macro that determines how the sectioning commands below construct the entries for the table of contents.

```

7486   \stex_csl_to_imports:No \usemodule \l__document_structure_sfragment_imports_tl
7487
7488   \bool_if:NT \l__document_structure_sfragment_loadmodules_bool {
7489     \sfragment@redefine@addtocontents{
7490       %\@ifundefined{module@id}\used@modules%
7491       %{\@ifundefined{module@\module@id @path}{\used@modules}\module@id}
7492     }
7493   }

```

now we only need to construct the right sectioning depending on the value of `\section@level`.

```

7494
7495   \stex_document_title:n { #2 }
7496
7497   \stex_patch_counters:
7498   \int_incr:N\l__document_structure_section_level_int
7499   \ifcase\l__document_structure_section_level_int
7500     \or\omdoc@sectioning[name=\omdoc@part@kw,clear,num]{part}{#2}
7501     \or\omdoc@sectioning[name=\omdoc@chapter@kw,clear,num]{chapter}{#2}
7502     \or\omdoc@sectioning[name=\omdoc@section@kw,num]{section}{#2}

```

```

7503 \or\omdoc@sectioning[name=\omdoc@subsection@kw,num]{subsection}{#2}
7504 \or\omdoc@sectioning[name=\omdoc@subsubsection@kw,num]{subsubsection}{#2}
7505 \or\omdoc@sectioning[name=\omdoc@paragraph@kw,ref=this \omdoc@paragraph@kw]{paragraph}{#1}
7506 \or\omdoc@sectioning[name=\omdoc@subparagraph@kw,ref=this \omdoc@subparagraph@kw]{subparagraph}{#1}
7507 \fi
7508 \at@begin@sfragment[#1]\l__document_structure_section_level_int{#2}
7509 \str_if_empty:NF \l__document_structure_sfragment_id_str {
7510   \stex_ref_new_doc_target:n\l__document_structure_sfragment_id_str
7511 }
7512 \stex_unpatch_counters:
7513 }% for customization
7514 {}

```

and finally, we localize the sections

```

7515 \newcommand\omdoc@part@kw{Part}
7516 \newcommand\omdoc@chapter@kw{Chapter}
7517 \newcommand\omdoc@section@kw{Section}
7518 \newcommand\omdoc@subsection@kw{Subsection}
7519 \newcommand\omdoc@subsubsection@kw{Subsubsection}
7520 \newcommand\omdoc@paragraph@kw{paragraph}
7521 \newcommand\omdoc@subparagraph@kw{subparagraph}

```

39.3 Front and Backmatter

Index markup is provided by the `omtext` package [[Kohlhase:smmtf:git](#)], so in the `document-structure` package we only need to supply the corresponding `\printindex` command, if it is not already defined

`\printindex`

```

7522 \providecommand\printindex{\IfFileExists{\jobname.ind}{\input{\jobname.ind}}{}}

```

(End definition for `\printindex`. This function is documented on page ??.)

some classes (e.g. `book.cls`) already have `\frontmatter`, `\mainmatter`, and `\backmatter` macros. As we want to define `frontmatter` and `backmatter` environments, we save their behavior (possibly defining it) in `orig@*matter` macros and make them undefined (so that we can define the environments).

```

7523 \cs_if_exist:NTF\frontmatter{
7524   \let\__document_structure_orig_frontmatter\frontmatter
7525   \let\frontmatter\relax
7526 }{
7527   \tl_set:Nn\__document_structure_orig_frontmatter{
7528     \clearpage
7529     \@mainmatterfalse
7530     \pagenumbering{roman}
7531   }
7532 }
7533 \cs_if_exist:NTF\backmatter{
7534   \let\__document_structure_orig_backmatter\backmatter
7535   \let\backmatter\relax
7536 }{
7537   \tl_set:Nn\__document_structure_orig_backmatter{
7538     \clearpage
7539     \@mainmatterfalse

```

```

7540 \pagenumbering{roman}
7541 }
7542 }

```

Using these, we can now define the `frontmatter` and `backmatter` environments

`frontmatter (env.)` we use the `\orig@frontmatter` macro defined above and `\mainmatter` if it exists, otherwise we define it.

```

7543 \newenvironment{frontmatter}{
7544   \_document\_structure\_orig\_frontmatter
7545 }{
7546   \cs\_if\_exist:NTF\mainmatter{
7547     \mainmatter
7548   }{
7549     \clearpage
7550     \@mainmattertrue
7551     \pagenumbering{arabic}
7552   }
7553 }

```

`backmatter (env.)` As `backmatter` is at the end of the document, we do nothing for `\endbackmatter`.

```

7554 \newenvironment{backmatter}{
7555   \_document\_structure\_orig\_backmatter
7556 }{
7557   \cs\_if\_exist:NTF\mainmatter{
7558     \mainmatter
7559   }{
7560     \clearpage
7561     \@mainmattertrue
7562     \pagenumbering{arabic}
7563   }
7564 }

```

finally, we make sure that page numbering is arabic and we have main matter as the default

```

7565 \@mainmattertrue\pagenumbering{arabic}

```

`\prematurestop` We initialize `\afterprematurestop`, and provide `\prematurestop@endsfragment` which looks up `\sfragment@level` and recursively ends enough `{sfragment}s`.

```

7566 \def \c__document\_structure\_document\_str{document}
7567 \newcommand\afterprematurestop{}
7568 \def\prematurestop@endsfragment{
7569   \unless\ifx\@currenvir\c__document\_structure\_document\_str
7570     \expandafter\expandafter\expandafter\end\expandafter\expandafter\expandafter{\expandafter
7571       \expandafter\prematurestop@endsfragment
7572     }
7573   }
7574 \providecommand\prematurestop{
7575   \message{Stopping~sTeX~processing~prematurely}
7576   \prematurestop@endsfragment
7577   \afterprematurestop
7578   \end{document}
7579 }

```

(End definition for `\prematurestop`. This function is documented on page 62.)

39.4 Global Variables

\setSGvar set a global variable

```
7580 \RequirePackage{etoolbox}
7581 \newcommand\setSGvar[1]{\@namedef{sTeX@Gvar@#1}}
```

(End definition for \setSGvar. This function is documented on page 62.)

\useSGvar use a global variable

```
7582 \newrobustcmd\useSGvar[1]{%
7583   \@ifundefined{sTeX@Gvar@#1}
7584   {\PackageError{document-structure}
7585     {The sTeX Global variable #1 is undefined}
7586     {set it with \protect\setSGvar}}
7587   \@nameuse{sTeX@Gvar@#1}}
```

(End definition for \useSGvar. This function is documented on page 62.)

\ifSGvar execute something conditionally based on the state of the global variable.

```
7588 \newrobustcmd\ifSGvar[3]{\def\@test{#2}%
7589   \@ifundefined{sTeX@Gvar@#1}
7590   {\PackageError{document-structure}
7591     {The sTeX Global variable #1 is undefined}
7592     {set it with \protect\setSGvar}}
7593   {\expandafter\ifx\csname sTeX@Gvar@#1\endcsname\@test #3\fi}}
```

(End definition for \ifSGvar. This function is documented on page 62.)

Chapter 40

NotesSlides – Implementation

40.1 Class and Package Options

We define some Package Options and switches for the `notesslides` class and activate them by passing them on to `beamer.cls` and `omdoc.cls` and the `notesslides` package. We pass the `nontheorem` option to the `statements` package when we are not in notes mode, since the `beamer` package has its own (overlay-aware) theorem environments.

```
7594 \*cls)
7595 \@@=notesslides)
7596 \ProvidesExplClass{notesslides}{2022/09/14}{3.2.0}{notesslides Class}
7597 \RequirePackage{13keys2e}
7598
7599 \keys_define:nn{notesslides / cls}{
7600   class .str_set_x:N = \c__notesslides_class_str,
7601   notes .bool_set:N = \c__notesslides_notes_bool ,
7602   slides .code:n = { \bool_set_false:N \c__notesslides_notes_bool },
7603   docopt .str_set_x:N = \c__notesslides_docopt_str,
7604   unknown .code:n = {
7605     \PassOptionsToPackage{\CurrentOption}{document-structure}
7606     \PassOptionsToClass{\CurrentOption}{beamer}
7607     \PassOptionsToPackage{\CurrentOption}{notesslides}
7608     \PassOptionsToPackage{\CurrentOption}{stex}
7609   }
7610 }
7611 \ProcessKeysOptions{ notesslides / cls }
7612
7613 \str_if_empty:NF \c__notesslides_class_str {
7614   \PassOptionsToPackage{class=\c__notesslides_class_str}{document-structure}
7615 }
7616
7617 \exp_args:No \str_if_eq:nnT\c__notesslides_class_str{book}{
7618   \PassOptionsToPackage{defaulttopsect=part}{notesslides}
7619 }
7620 \exp_args:No \str_if_eq:nnT\c__notesslides_class_str{report}{
7621   \PassOptionsToPackage{defaulttopsect=part}{notesslides}
7622 }
7623
7624 \RequirePackage{stex}
```



```

7625 \stex_html_backend:T {
7626   \bool_set_true:N\c__notesslides_notes_bool
7627 }
7628
7629 \bool_if:NTF \c__notesslides_notes_bool {
7630   \PassOptionsToPackage{notes=true}{notesslides}
7631   \message{notesslides.cls:~Formatting~course~materials~in~notes~mode}
7632 }{
7633   \PassOptionsToPackage{notes=false}{notesslides}
7634   \message{notesslides.cls:~Formatting~course~materials~in~slides~mode}
7635 }
7636 </cls>

```

now we do the same for the notesslides package.

```

7637 <*package>
7638 \ProvidesExplPackage{notesslides}{2022/09/14}{3.2.0}{notesslides Package}
7639 \RequirePackage{l3keys2e}
7640
7641 \keys_define:nn{notesslides / pkg}{
7642   topsect          .str_set_x:N = \c__notesslides_topsect_str,
7643   defaulttopsect   .str_set_x:N = \c__notesslides_defaulttopsec_str,
7644   notes            .bool_set:N = \c__notesslides_notes_bool ,
7645   slides           .code:n      = { \bool_set_false:N \c__notesslides_notes_bool },
7646   sectocframes     .bool_set:N = \c__notesslides_sectocframes_bool ,
7647   frameimages      .bool_set:N = \c__notesslides_frameimages_bool ,
7648   fiboxed          .bool_set:N = \c__notesslides_fiboxed_bool ,
7649   noproblems       .bool_set:N = \c__notesslides_noproblems_bool,
7650   unknown          .code:n      = {
7651     \PassOptionsToClass{\CurrentOption}{stex}
7652     \PassOptionsToClass{\CurrentOption}{tikzinput}
7653   }
7654 }
7655 \ProcessKeysOptions{ notesslides / pkg }
7656
7657 \RequirePackage{stex}
7658 \stex_html_backend:T {
7659   \bool_set_true:N\c__notesslides_notes_bool
7660 }
7661
7662 \newif\ifnotes
7663 \bool_if:NTF \c__notesslides_notes_bool {
7664   \notesttrue
7665 }{
7666   \notesfalse
7667 }
7668

```

we give ourselves a macro \@@topsect that needs only be evaluated once, so that the \ifdefstring conditionals work below.

```

7669 \str_if_empty:NTF \c__notesslides_topsect_str {
7670   \str_set_eq:NN \__notesslides_topsect \c__notesslides_defaulttopsec_str
7671 }{
7672   \str_set_eq:NN \__notesslides_topsect \c__notesslides_topsect_str
7673 }
7674 \PassOptionsToPackage{topsect=\__notesslides_topsect}{document-structure}

```

```
7675 </package>
```

Depending on the options, we either load the `article`-based document-structure or the `beamer` class (and set some counters).

```
7676 <*cls>
7677 \bool_if:NTF \c__notesslides_notes_bool {
7678   \str_if_empty:NT \c__notesslides_class_str {
7679     \str_set:Nn \c__notesslides_class_str {article}
7680   }
7681   \exp_after:wN\LoadClass\exp_after:wN[\c__notesslides_dcopt_str]
7682     {\c__notesslides_class_str}
7683 }{
7684   \LoadClass[10pt,notheorems,xcolor={dvipsnames,svgnames}]{beamer}
7685   \newcounter{Item}
7686   \newcounter{paragraph}
7687   \newcounter{subparagraph}
7688   \newcounter{Hfootnote}
7689 }
7690 \RequirePackage{document-structure}
```

now it only remains to load the `notesslides` package that does all the rest.

```
7691 \RequirePackage{notesslides}
7692 </cls>
```

In `notes` mode, we also have to make the `beamer`-specific things available to `article` via the `beamerarticle` package. We use options to avoid loading theorem-like environments, since we want to use our own from the \TeX packages. The first batch of packages we want are loaded on `notesslides.sty`. These are the general ones, we will load the \TeX -specific ones after we have done some work (e.g. defined the counters `m*`). Only the `stex-logo` package is already needed now for the default theme.

```
7693 <*package>
7694 \bool_if:NT \c__notesslides_notes_bool {
7695   \RequirePackage{a4wide}
7696   \RequirePackage{marginnote}
7697   \PassOptionsToPackage{usenames,dvipsnames,svgnames}{xcolor}
7698   \RequirePackage{mdframed}
7699   \RequirePackage[noxcolor,noamsthm]{beamerarticle}
7700   \RequirePackage[bookmarks,bookmarksopen,bookmarksnumbered,breaklinks,hidelinks]{hyperref}
7701 }
7702 \RequirePackage{stex-tikzinput}
7703 \RequirePackage{comment}
7704 \RequirePackage{url}
7705 \RequirePackage{graphicx}
7706 \RequirePackage{pgf}
7707 \RequirePackage{bookmark}
```

40.2 Notes and Slides

For the lecture notes cases, we also provide the `\usetheme` macro that would otherwise come from the `beamer` class.

```
7708 \bool_if:NT \c__notesslides_notes_bool {
7709   \renewcommand\usetheme[2][\usepackage{#1}{beamertheme#2}]
7710 }
```

```

7711 \NewDocumentCommand \libusetheme {0{} m} {
7712   \libusepackage[#1]{beamertheme#2}
7713 }
7714

```

We define the sizes of slides in the notes. Somehow, we cannot get by with the same here.

```

7715 \newcounter{slide}
7716 \newlength{\slidewidth}\setlength{\slidewidth}{13.5cm}
7717 \newlength{\slideheight}\setlength{\slideheight}{9cm}

```

note (*env.*) The **note** environment is used to leave out text in the **slides** mode. It does not have a counterpart in OMDoc. So for course notes, we define the **note** environment to be a no-operation otherwise we declare the **note** environment as a comment via the **comment** package.

```

7718 \bool_if:NTF \c__notesslides_notes_bool {
7719   \renewenvironment{note}{\ignorespaces}{}
7720 }{
7721   \excludecomment{note}
7722 }

```

We first set up the slide boxes in **article** mode. We set up sizes and provide a box register for the frames and a counter for the slides.

```

7723 \bool_if:NT \c__notesslides_notes_bool {
7724   \newlength{\slideframewidth}
7725   \setlength{\slideframewidth}{1.5pt}

```

frame (*env.*) We first define the keys.

```

7726 \cs_new_protected:Nn \__notesslides_do_yes_param:Nn {
7727   \exp_args:Nx \str_if_eq:nnTF { \str_uppercase:n{ #2 } }{ yes }{
7728     \bool_set_true:N #1
7729   }{
7730     \bool_set_false:N #1
7731   }
7732 }
7733 \keys_define:nn{notesslides / frame}{
7734   label .str_set_x:N = \l__notesslides_frame_label_str,
7735   allowframebreaks .code:n = {
7736     \__notesslides_do_yes_param:Nn \l__notesslides_frame_allowframebreaks_bool { #1 }
7737   },
7738   allowdisplaybreaks .code:n = {
7739     \__notesslides_do_yes_param:Nn \l__notesslides_frame_allowdisplaybreaks_bool { #1 }
7740   },
7741   fragile .code:n = {
7742     \__notesslides_do_yes_param:Nn \l__notesslides_frame_fragile_bool { #1 }
7743   },
7744   shrink .code:n = {
7745     \__notesslides_do_yes_param:Nn \l__notesslides_frame_shrink_bool { #1 }
7746   },
7747   squeeze .code:n = {
7748     \__notesslides_do_yes_param:Nn \l__notesslides_frame_squeeze_bool { #1 }
7749   },
7750   t .code:n = {

```

```

7751     \_notesslides_do_yes_param:Nn \l__notesslides_frame_t_bool { #1 }
7752   },
7753   unknown    .code:n      = {}
7754 }
7755 \cs_new_protected:Nn \_notesslides_frame_args:n {
7756   \str_clear:N \l__notesslides_frame_label_str
7757   \bool_set_true:N \l__notesslides_frame_allowframebreaks_bool
7758   \bool_set_true:N \l__notesslides_frame_allowdisplaybreaks_bool
7759   \bool_set_true:N \l__notesslides_frame_fragile_bool
7760   \bool_set_true:N \l__notesslides_frame_shrink_bool
7761   \bool_set_true:N \l__notesslides_frame_squeeze_bool
7762   \bool_set_true:N \l__notesslides_frame_t_bool
7763   \keys_set:nn { notesslides / frame }{ #1 }
7764 }

```

We define the environment, read them, and construct the slide number and label.

```

7765 \renewenvironment{frame}[1][]{
7766   \_notesslides_frame_args:n{#1}
7767   \sffamily
7768   \stepcounter{slide}
7769   \def\@currentlabel{\theslide}
7770   \str_if_empty:NF \l__notesslides_frame_label_str {
7771     \label{\l__notesslides_frame_label_str}
7772   }

```

We redefine the `itemize` environment so that it looks more like the one in `beamer`.

```

7773 \def\itemize@level{outer}
7774 \def\itemize@outer{outer}
7775 \def\itemize@inner{inner}
7776 \renewcommand\newpage{\addtocounter{framenumber}{1}}
7777 %\newcommand\metakeys@show@keys[2]{\marginnote{\scriptsize ##2}}
7778 \renewenvironment{itemize}{
7779   \ifx\itemize@level\itemize@outer
7780     \def\itemize@label{$\rhd$}
7781   \fi
7782   \ifx\itemize@level\itemize@inner
7783     \def\itemize@label{$\scriptstyle\rhd$}
7784   \fi
7785   \begin{list}
7786     {\itemize@label}
7787     {\setlength{\labelsep}{.3em}
7788      \setlength{\labelwidth}{.5em}
7789      \setlength{\leftmargin}{1.5em}
7790     }
7791   \edef\itemize@level{\itemize@inner}
7792 }{
7793   \end{list}
7794 }

```

We create the box with the `mdframed` environment from the `equinymous` package.

```

7795 \stex_html_backend:TF {
7796   \begin{stex_annotate_env}{frame}{}\vbox\bgroup
7797     \mdf@patchamsthm
7798 }{
7799   \begin{mdframed}[linewidth=\slideframewidth,skipabove=1ex,skipbelow=1ex,userdefinedwid

```

```

7800     }
7801   }{
7802     \stex_html_backend:TF {
7803       \miko@slidelabel\egroup\end{stex_annotate_env}
7804     }\medskip\miko@slidelabel\end{mdframed}}
7805   }

```

Now, we need to redefine the frametitle (we are still in course notes mode).

`\frametitle`

```

7806   \renewcommand{\frametitle}[1]{
7807     \stex_document_title:n { #1 }
7808     {\Large\bf\sf\color{blue}{#1}}\medskip
7809   }
7810 }

```

(End definition for `\frametitle`. This function is documented on page ??.)

EdN:10

`\pause` 10

```

7811 \bool_if:NT \c__notesslides_notes_bool {
7812   \newcommand\pause{}
7813 }

```

(End definition for `\pause`. This function is documented on page ??.)

`nparagraph (env.)`

```

7814 \bool_if:NTF \c__notesslides_notes_bool {
7815   \newenvironment{nparagraph}[1] [] {\begin{sparagraph}[#1]}\end{sparagraph}}
7816 }{
7817   \excludecomment{nparagraph}
7818 }

```

`nfragment (env.)`

```

7819 \bool_if:NTF \c__notesslides_notes_bool {
7820   \newenvironment{nfragment}[2] [] {\begin{sfragment}[#1][#2]}\end{sfragment}}
7821 }{
7822   \excludecomment{nfragment}
7823 }

```

`ndefinition (env.)`

```

7824 \bool_if:NTF \c__notesslides_notes_bool {
7825   \newenvironment{ndefinition}[1] [] {\begin{sdefinition}[#1]}\end{sdefinition}}
7826 }{
7827   \excludecomment{ndefinition}
7828 }

```

`nassertion (env.)`

```

7829 \bool_if:NTF \c__notesslides_notes_bool {
7830   \newenvironment{nassertion}[1] [] {\begin{sassertion}[#1]}\end{sassertion}}
7831 }{
7832   \excludecomment{nassertion}
7833 }

```

¹⁰EDNOTE: MK: fake it in notes mode for now

`nsproof (env.)`

```
7834 \bool_if:NTF \c__notesslides_notes_bool {
7835   \newenvironment{nproof}[2] [] {\begin{sproof}[#1]{#2}}{\end{sproof}}
7836 }{
7837   \excludecomment{nproof}
7838 }
```

`nexample (env.)`

```
7839 \bool_if:NTF \c__notesslides_notes_bool {
7840   \newenvironment{nexample}[1] [] {\begin{sexample}[#1]}{\end{sexample}}
7841 }{
7842   \excludecomment{nexample}
7843 }
```

`\inputref@*skip` We customize the hooks for in `\inputref`.

```
7844 \def\inputref@preskip{\smallskip}
7845 \def\inputref@postskip{\medskip}
```

*(End definition for \inputref@*skip. This function is documented on page ??.)*

`\inputref*`

```
7846 \let\orig@inputref\inputref
7847 \def\inputref{\@ifstar\ninputref\orig@inputref}
7848 \newcommand\ninputref[2] []{
7849   \bool_if:NT \c__notesslides_notes_bool {
7850     \orig@inputref[#1]{#2}
7851   }
7852 }
```

(End definition for \inputref. This function is documented on page 64.)*

40.3 Header and Footer Lines

Now, we set up the infrastructure for the footer line of the slides, we use boxes for the logos, so that they are only loaded once, that considerably speeds up processing.

`\setslidelogo` The default logo is the `STEX` logo. Customization can be done by `\setslidelogo{<logo name>}`.

```
7853 \newlength{\slidelogoheight}
7854
7855 \RequirePackage{graphicx}
7856
7857 \define@key{Gin}{mhrepos}{\def\Gin@mhrepos{#1}}
7858 \providecommand\mhgraphics[2] []{
7859   \def\Gin@mhrepos{}\setkeys{Gin}{#1}
7860   \includegraphics[#1]{\mhp\Gin@mhrepos{#2}}
7861 }
7862
7863 \bool_if:NTF \c__notesslides_notes_bool {
7864   \setlength{\slidelogoheight}{.4cm}
7865 }{
7866   \setlength{\slidelogoheight}{.25cm}
7867 }
```

```

7868 \ifcsname slidelogo\endcsname\else
7869 \newsavebox{\slidelogo}
7870 \sbox{\slidelogo}{\sTeX}
7871 \fi
7872 \newrobustcmd{\setslidelogo}[2][\{
7873 \tl_if_empty:nTF{#1}{
7874 \sbox{\slidelogo}{\includegraphics[height=\slidelogoheight]{#2}}
7875 }{
7876 \sbox{\slidelogo}{\mhgraphics[height=\slidelogoheight,mhrepos=#1]{#2}}
7877 }
7878 }

```

(End definition for `\setslidelogo`. This function is documented on page 65.)

\author In notes mode, we redefine the `\author` macro so that it does not disregard the optional argument (as `beamerarticle` does). We want to use it to set the source later.

```

7879 \bool_if:NT \c__notesslides_notes_bool {
7880 \def\author{\@dblarg\@ns@author}
7881 \long\def\@ns@author[#1]#2{%
7882 \def\c__notesslides_shortauthor{#1}%
7883 \def\@author{#2}
7884 }
7885 }

```

(End definition for `\author`. This function is documented on page ??.)

\setsource `\source` stores the writer's name. By default it is *Michael Kohlhase* since he is the main user and designer of this package. `\setsource{<name>}` can change the writer's name.

```

7886 \newrobustcmd{\setsource}[1]{\def\source{#1}}

```

(End definition for `\setsource`. This function is documented on page 65.)

\setlicensing Now, we set up the copyright and licensing. By default we use the Creative Commons Attribution-ShareAlike license to strengthen the public domain. If package `hyperref` is loaded, then we can attach a hyperlink to the license logo. `\setlicensing[<url>]{<logo name>}` is used for customization, where `<url>` is optional.

```

7887 \def\copyrightnotice{%
7888 \footnotesize\copyright : \hspace{.3ex}%
7889 \ifcsname source\endcsname\source\else%
7890 \ifcsname c__notesslides_shortauthor\endcsname\c__notesslides_shortauthor\else%
7891 \PackageWarning{notesslides}{Author/Source-undefined-in-copyright-notice}%
7892 ?source/author?\fi%
7893 \fi}
7894 \newsavebox{\cclogo}
7895 \sbox{\cclogo}{\includegraphics[height=\slidelogoheight]{stex-cc_somerights}}
7896 \newif\ifcchref\cchreffalse
7897 \AtBeginDocument{
7898 \@ifpackageloaded{hyperref}{\cchreftrue}{\cchreffalse}
7899 }
7900 \def\licensing{
7901 \ifcchref
7902 \href{http://creativecommons.org/licenses/by-sa/2.5/}{\usebox{\cclogo}}
7903 \else
7904 {\usebox{\cclogo}}

```

```

7905 \fi
7906 }
7907 \newrobustcmd{\setlicensing}[2][]{
7908   \def\@url{#1}
7909   \sbox{\cclogo}{\includegraphics[height=\slidelogoheight]{#2}}
7910   \ifx\@url\@empty
7911     \def\licensing{\usebox{\cclogo}}
7912   \else
7913     \def\licensing{
7914       \ifcchref
7915         \href{#1}{\usebox{\cclogo}}
7916       \else
7917         {\usebox{\cclogo}}
7918       \fi
7919     }
7920 \fi
7921 }

```

(End definition for \setlicensing. This function is documented on page 65.)

EdN:11

```

\slidelabel Now, we set up the slide label for the article mode.11
7922 \newrobustcmd\miko@slidelabel{
7923   \vbox to \slidelogoheight{
7924     \vss\hbox to \slidewidth
7925       {\licensing\hfill\copyrightnotice\hfill\arabic{slide}\hfill\usebox{\slidelogo}}
7926   }
7927 }

```

(End definition for \slidelabel. This function is documented on page ??.)

40.4 Frame Images

\frameimage We have to make sure that the width is overwritten, for that we check the \Gin@ewidth macro from the graphicx package. We also add the label key.

```

7928 \def\Gin@mhrepos{}
7929 \define@key{Gin}{mhrepos}{\def\Gin@mhrepos{#1}}
7930 \define@key{Gin}{label}{\def\@currentlabel{\arabic{slide}}\label{#1}}
7931 \newrobustcmd\frameimage[2][]{
7932   \stepcounter{slide}
7933   \bool_if:NT \c__notesslides_frameimages_bool {
7934     \def\Gin@ewidth{}\setkeys{Gin}{#1}
7935     \bool_if:NF \c__notesslides_notes_bool { \vfill }
7936     \begin{center}
7937       \bool_if:NTF \c__notesslides_fiboxed_bool {
7938         \fbox{
7939           \ifx\Gin@ewidth\@empty
7940             \ifx\Gin@mhrepos\@empty
7941               \mhgraphics[width=\slidewidth,#1]{#2}
7942             \else
7943               \mhgraphics[width=\slidewidth,#1,mhrepos=\Gin@mhrepos]{#2}
7944             \fi
7945           \else% Gin@ewidth empty

```

¹¹EdNOTE: see that we can use the themes for the slides some day. This is all fake.


```

7946         \ifx\Gin@mhrepos\@empty
7947         \mhgraphics[#1]{#2}
7948     \else
7949         \mhgraphics[#1,mhrepos=\Gin@mhrepos]{#2}
7950     \fi
7951 \fi% Gin@ewidth empty
7952 }
7953 }{
7954     \ifx\Gin@ewidth\@empty
7955     \ifx\Gin@mhrepos\@empty
7956         \mhgraphics[width=\slidewidth,#1]{#2}
7957     \else
7958         \mhgraphics[width=\slidewidth,#1,mhrepos=\Gin@mhrepos]{#2}
7959     \fi
7960     \ifx\Gin@mhrepos\@empty
7961         \mhgraphics[#1]{#2}
7962     \else
7963         \mhgraphics[#1,mhrepos=\Gin@mhrepos]{#2}
7964     \fi
7965     \fi% Gin@ewidth empty
7966 }
7967 \end{center}
7968 \par\strut\hfill{\footnotesize Slide \arabic{slide}}}%
7969 \bool_if:NF \c__notesslides_notes_bool { \vfill }
7970 }
7971 } % ifmks@sty@frameimages

```

(End definition for `\frameimage`. This function is documented on page 65.)

40.5 Sectioning

If the `sectocframes` option is set, then we make section frames. We first define counters for `part` and `chapter`, which `beamer.cls` does not have and we make the `section` counter which it does dependent on `chapter`.

```

7972 \stex_html_backend:F {
7973     \bool_if:NT \c__notesslides_sectocframes_bool {
7974         \str_if_eq:VnTF \__notesslidestopsect{part}{
7975             \newcounter{chapter}\counterwithin*{section}{chapter}
7976         }{
7977             \str_if_eq:VnT\__notesslidestopsect{chapter}{
7978                 \newcounter{chapter}\counterwithin*{section}{chapter}
7979             }
7980         }
7981     }
7982 }

```

`\section@level` We set the `\section@level` counter that governs sectioning according to the class options. We also introduce the sectioning counters accordingly.

```

\section@level
7983 \def\part@prefix{}
7984 \@ifpackageloaded{document-structure}{
7985     \str_case:VnF \__notesslidestopsect {

```

```

7986 {part}{
7987   \int_set:Nn \l_document_structure_section_level_int {0}
7988   \def\thesection{\arabic{chapter}.\arabic{section}}
7989   \def\part@prefix{\arabic{chapter}.}
7990 }
7991 {chapter}{
7992   \int_set:Nn \l_document_structure_section_level_int {1}
7993   \def\thesection{\arabic{chapter}.\arabic{section}}
7994   \def\part@prefix{\arabic{chapter}.}
7995 }
7996 }{
7997   \int_set:Nn \l_document_structure_section_level_int {2}
7998   \def\part@prefix{}
7999 }
8000 }
8001
8002 \bool_if:NF \c__notesslides_notes_bool { % only in slides

```

(End definition for \section@level. This function is documented on page ??.)

The new counters are used in the `sfragment` environment that chooses the L^AT_EX sectioning macros according to `\section@level`.

`sfragment (env.)`

```

8003 \renewenvironment{sfragment}[2][]{
8004   \__document_structure_sfragment_args:n { #1 }
8005   \int_incr:N \l_document_structure_section_level_int
8006   \bool_if:NT \c__notesslides_sectocframes_bool {
8007     \stepcounter{slide}
8008     \begin{frame}[noframenumbering]
8009     \vfill\Large\centering
8010     \red{
8011       \ifcase\l_document_structure_section_level_int\or
8012         \stepcounter{part}
8013         \def\__notesslideslabel{\omdoc@part@kw}~\Roman{part}}
8014         \addcontentsline{toc}{part}{\protect\numberline{\thepart}#2}
8015         \pdfbookmark[0]{\thepart\ #2}{part.\thepart}
8016         \def\currentsectionlevel{\omdoc@part@kw}
8017       \or
8018         \stepcounter{chapter}
8019         \def\__notesslideslabel{\omdoc@chapter@kw}~\arabic{chapter}}
8020         \addcontentsline{toc}{chapter}{\protect\numberline{\thechapter}#2}
8021         \pdfbookmark[1]{\thechapter\ #2}{chapter.\cs_if_exist:cT{\thepart}\thepart.\thechapter}
8022         \def\currentsectionlevel{\omdoc@chapter@kw}
8023       \or
8024         \stepcounter{section}
8025         \def\__notesslideslabel{\part@prefix\arabic{section}}
8026         \addcontentsline{toc}{section}{\protect\numberline{\thesection}#2}
8027         \pdfbookmark[2]{\cs_if_exist:cT{\thechapter}{\thechapter}.\thesection\ #2}
8028         {section.\cs_if_exist:cT{\thepart}{\thepart}.\cs_if_exist:cT{\thechapter}{\thechapter}.\thepart}
8029         \def\currentsectionlevel{\omdoc@section@kw}
8030       \or
8031         \stepcounter{subsection}
8032         \def\__notesslideslabel{\part@prefix\arabic{section}.\arabic{subsection}}
8033         \addcontentsline{toc}{subsection}{\protect\numberline{\thesubsection}#2}

```

```

8034         \pdfbookmark[3]{\cs_if_exist:cT{thechapter}{\thechapter.}\thesection.\thesubsection
8035         {subsection.\cs_if_exist:cT{thepart}{\thepart}.\cs_if_exist:cT{thechapter}{\thechapter.}\thesection.\thesubsection}
8036         \def\currentsectionlevel{\omdoc@subsection@kw}
8037     \or
8038         \stepcounter{subsubsection}
8039         \def\__notesslideslabel{\part@prefix\arabic{section}.\arabic{subsection}.\arabic{subsubsection}}
8040         \addcontentsline{toc}{subsubsection}{\protect\numberline{\thesubsubsection}#2}
8041         \pdfbookmark[4]{\cs_if_exist:cT{thechapter}{\thechapter.}\thesection.\thesubsection.\thesubsubsection}
8042         {subsubsection.\cs_if_exist:cT{thepart}{\thepart}.\cs_if_exist:cT{thechapter}{\thechapter.}\thesection.\thesubsubsection}
8043         \def\currentsectionlevel{\omdoc@subsubsection@kw}
8044     \or
8045         \stepcounter{paragraph}
8046         \def\__notesslideslabel{\part@prefix\arabic{section}.\arabic{subsection}.\arabic{paragraph}}
8047         \addcontentsline{toc}{paragraph}{\protect\numberline{\theparagraph}#2}
8048         \pdfbookmark[5]{\cs_if_exist:cT{thechapter}{\thechapter.}\thesection.\thesubsection.\theparagraph}
8049         {paragraph.\cs_if_exist:cT{thepart}{\thepart}.\cs_if_exist:cT{thechapter}{\thechapter.}\thesection.\theparagraph}
8050         \def\currentsectionlevel{\omdoc@paragraph@kw}
8051     \else
8052         \def\__notesslideslabel{}
8053         \def\currentsectionlevel{\omdoc@paragraph@kw}
8054     \fi% end ifcase
8055     \__notesslideslabel\quad #2%
8056 }%
8057 \vfill%
8058 \end{frame}%
8059 }
8060 \str_if_empty:NF \l__document_structure_sfragment_id_str {
8061     \stex_ref_new_doc_target:n\l__document_structure_sfragment_id_str
8062 }
8063 }{}
8064 }

```

We set up a beamer template for theorems like ams style, but without a block environment.

```

8065 \def\inserttheorembodyfont{\normalfont}
8066 %\bool_if:NF \c__notesslides_notes_bool {
8067 %   \defbeamertemplate{theorem begin}{miko}
8068 %   {\inserttheoremheadfont\inserttheoremname\inserttheoremnumber
8069 %    \ifx\inserttheoremaddition@empty\else\ (\inserttheoremaddition)\fi%
8070 %    \inserttheorempunctuation\inserttheorembodyfont\xspace}
8071 %   \defbeamertemplate{theorem end}{miko}{}}

```

and we set it as the default one.

```

8072 % \setbeamertemplate{theorems}[miko]

```

The following fixes an error I do not understand, this has something to do with beamer compatibility, which has similar definitions but only up to 1.

```

8073 % \expandafter\def\csname Parent2\endcsname{}
8074 %}
8075
8076 \AddToHook{begindocument}{ % this does not work for some reason
8077     \setbeamertemplate{theorems}[ams style]
8078 }
8079 \bool_if:NT \c__notesslides_notes_bool {
8080     \renewenvironment{columns}[1][\%

```

```

8081     \par\noindent%
8082     \begin{minipage}%
8083     \slidewidth\centering\leavevmode%
8084   }{%
8085     \end{minipage}\par\noindent%
8086   }%
8087   \newsavebox\columnbox%
8088   \renewenvironment<>{column}[2][]{%
8089     \begin{lrbox}{\columnbox}\begin{minipage}{#2}%
8090   }{%
8091     \end{minipage}\end{lrbox}\usebox\columnbox%
8092   }%
8093 }

8094 \bool_if:NTF \c__notesslides_noproblems_bool {
8095   \newenvironment{problems}{}{}
8096 }{
8097   \excludacomment{problems}
8098 }

```

40.6 Excursions

\excursion The excursion macros are very simple, we define a new internal macro `\excursionref` and use it in `\excursion`, which is just an `\inputref` that checks if the new macro is defined before formatting the file in the argument.

```

8099 \gdef\printexcursions{}
8100 \newcommand\excursionref[2]{% label, text
8101   \bool_if:NT \c__notesslides_notes_bool {
8102     \begin{sparagraph}[title=Excursion]
8103       #2 \sref[fallback=the appendix]{#1}.
8104     \end{sparagraph}
8105   }
8106 }
8107 \newcommand\activate@excursion[2][]{
8108   \gappto\printexcursions{\inputref{#1}{#2}}
8109 }
8110 \newcommand\excursion[4][]{% repos, label, path, text
8111   \bool_if:NT \c__notesslides_notes_bool {
8112     \activate@excursion{#1}{#3}\excursionref{#2}{#4}
8113   }
8114 }

```

(End definition for `\excursion`. This function is documented on page 66.)

\excursiongroup

```

8115 \keys_define:nn{notesslides / excursiongroup }{
8116   id          .str_set_x:N = \l__notesslides_excursion_id_str,
8117   intro       .tl_set:N   = \l__notesslides_excursion_intro_tl,
8118   mhrepos     .str_set_x:N = \l__notesslides_excursion_mhrepos_str
8119 }
8120 \cs_new_protected:Nn \__notesslides_excursion_args:n {
8121   \tl_clear:N \l__notesslides_excursion_intro_tl
8122   \str_clear:N \l__notesslides_excursion_id_str

```

```

8123 \str_clear:N \l__notesslides_excursion_mhrepos_str
8124 \keys_set:nn {notesslides / excursionsgroup }{ #1 }
8125 }
8126 \newcommand\excursionsgroup[1][ ]{
8127   \__notesslides_excursion_args:n{ #1 }
8128   \ifdefempty\printexcursions{}% only if there are excursions
8129   {\begin{note}
8130     \begin{sfragment}[#1]{Excursions}%
8131     \ifdefempty\l__notesslides_excursion_intro_tl}{
8132       \inputref[\l__notesslides_excursion_mhrepos_str]{
8133         \l__notesslides_excursion_intro_tl
8134       }
8135     }
8136     \printexcursions%
8137     \end{sfragment}
8138   \end{note}}
8139 }
8140 \ifcsname beameritemnestingprefix\endcsname\else\def\beameritemnestingprefix{}\fi
8141 \end{package}

```

(End definition for \excursionsgroup. This function is documented on page 66.)

Chapter 41

The Implementation

41.1 Package Options

The first step is to declare (a few) package options that handle whether certain information is printed or not. They all come with their own conditionals that are set by the options.

```
8142 <*package>
8143 <@@=problems>
8144 \ProvidesExplPackage{problem}{2022/09/14}{3.2.0}{Semantic Markup for Problems}
8145 \RequirePackage{13keys2e}
8146 \RequirePackage{amssymb}% for \Box
8147
8148 \keys_define:nn { problem / pkg }{
8149   notes      .default:n    = { true },
8150   notes      .bool_set:N   = \c__problems_notes_bool,
8151   gnotes     .default:n    = { true },
8152   gnotes     .bool_set:N   = \c__problems_gnotes_bool,
8153   hints      .default:n    = { true },
8154   hints      .bool_set:N   = \c__problems_hints_bool,
8155   solutions  .default:n    = { true },
8156   solutions  .bool_set:N   = \c__problems_solutions_bool,
8157   pts        .default:n    = { true },
8158   pts        .bool_set:N   = \c__problems_pts_bool,
8159   min        .default:n    = { true },
8160   min        .bool_set:N   = \c__problems_min_bool,
8161   boxed      .default:n    = { true },
8162   boxed      .bool_set:N   = \c__problems_boxed_bool,
8163   test       .default:n    = { true },
8164   test       .bool_set:N   = \c__problems_test_bool,
8165   unknown    .code:n       = {
8166     \PassOptionsToPackage{\CurrentOption}{stex}
8167   }
8168 }
8169 \newif\ifsolutions
8170
8171 \ProcessKeysOptions{ problem / pkg }
8172 \bool_if:NTF \c__problems_solutions_bool {
8173   \solutionstrue
```

```

8174 }{
8175   \solutionsfalse
8176 }
8177 \RequirePackage{stex}

```

Then we make sure that the necessary packages are loaded (in the right versions).

```

8178 \RequirePackage{comment}

```

The next package relies on the L^AT_EX3 kernel, which L^AT_EXML only partially supports. As it is purely presentational, we only load it when the `boxed` option is given and we run L^AT_EXML.

```

8179 \bool_if:NT \c__problems_boxed_bool { \RequirePackage{mdframed} }

```

`\prob@*@kw` For multilinguality, we define internal macros for keywords that can be specialized in `*.ldf` files.

```

8180 \def\prob@problem@kw{Problem}
8181 \def\prob@solution@kw{Solution}
8182 \def\prob@hint@kw{Hint}
8183 \def\prob@note@kw{Note}
8184 \def\prob@grade@kw{Grading}
8185 \def\prob@pt@kw{pt}
8186 \def\prob@min@kw{min}
8187 \def\prob@correct@kw{Correct}
8188 \def\prob@wrong@kw{Wrong}

```

(End definition for `\prob@*@kw`. This function is documented on page ??.)

For the other languages, we set up triggers

```

8189 \AddToHook{begindocument}{
8190   \ltx@ifpackageloaded{babel}{
8191     \makeatletter
8192     \clist_set:Nx \l_tmpa_clist {\bbl@loaded}
8193     \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\detokenize{ngerman}}{
8194       \input{problem-ngerman.ldf}
8195     }
8196     \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\detokenize{finnish}}{
8197       \input{problem-finnish.ldf}
8198     }
8199     \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\detokenize{french}}{
8200       \input{problem-french.ldf}
8201     }
8202     \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\detokenize{russian}}{
8203       \input{problem-russian.ldf}
8204     }
8205     \makeatother
8206   }{ }
8207 }

```

41.2 Problems and Solutions

We now prepare the KeyVal support for problems. The key macros just set appropriate internal macros.

```

8208 \keys_define:nn{ problem / problem }{
8209   id .str_set_x:N = \l__problems_prob_id_str,

```

```

8210 pts      .tl_set:N      = \l__problems_prob_pts_tl,
8211 min      .tl_set:N      = \l__problems_prob_min_tl,
8212 title     .tl_set:N      = \l__problems_prob_title_tl,
8213 type      .tl_set:N      = \l__problems_prob_type_tl,
8214 imports   .tl_set:N      = \l__problems_prob_imports_tl,
8215 name      .str_set_x:N    = \l__problems_prob_name_str,
8216 refnum    .int_set:N      = \l__problems_prob_refnum_int
8217 }
8218 \cs_new_protected:Nn \__problems_prob_args:n {
8219   \str_clear:N \l__problems_prob_id_str
8220   \str_clear:N \l__problems_prob_name_str
8221   \tl_clear:N \l__problems_prob_pts_tl
8222   \tl_clear:N \l__problems_prob_min_tl
8223   \tl_clear:N \l__problems_prob_title_tl
8224   \tl_clear:N \l__problems_prob_type_tl
8225   \tl_clear:N \l__problems_prob_imports_tl
8226   \int_zero_new:N \l__problems_prob_refnum_int
8227   \keys_set:nn { problem / problem }{ #1 }
8228   \int_compare:nNnT \l__problems_prob_refnum_int = 0 {
8229     \let\l__problems_prob_refnum_int\undefined
8230   }
8231 }

```

Then we set up a counter for problems.

`\numberproblemsin`

```

8232 \newcounter{problem}[section]
8233 \newcommand\numberproblemsin[1]{\@addtoreset{problem}{#1}}
8234 \def\theplainsproblem{\arabic{problem}}
8235 \def\thesproblem{\thesection.\theplainsproblem}

(End definition for \numberproblemsin. This function is documented on page ??.)

```

`\prob@label` We provide the macro `\prob@label` to redefine later to get context involved.

```

8236 \newcommand\prob@label[1]{\thesection.#1}

(End definition for \prob@label. This function is documented on page ??.)

```

`\prob@number` We consolidate the problem number into a reusable internal macro

```

8237 \newcommand\prob@number{
8238   \int_if_exist:NTF \l__problems_inclprob_refnum_int {
8239     \prob@label{\int_use:N \l__problems_inclprob_refnum_int }
8240   }{
8241     \int_if_exist:NTF \l__problems_prob_refnum_int {
8242       \prob@label{\int_use:N \l__problems_prob_refnum_int }
8243     }{
8244       \prob@label\theplainsproblem
8245     }
8246   }
8247 }
8248 \def\sproblemautorefname{\prob@problem@kw}

```

(End definition for `\prob@number`. This function is documented on page ??.)

`\prob@title` We consolidate the problem title into a reusable internal macro as well. `\prob@title` takes three arguments the first is the fallback when no title is given at all, the second and third go around the title, if one is given.

```

8249 \newcommand\prob@title[3]{%
8250   \tl_if_exist:NTF \l__problems_inclprob_title_tl {
8251     #2 \l__problems_inclprob_title_tl #3
8252   }{
8253     \tl_if_empty:NTF \l__problems_prob_title_tl {
8254       #1
8255     }{
8256       #2 \l__problems_prob_title_tl #3
8257     }
8258   }
8259 }

```

(End definition for `\prob@title`. This function is documented on page ??.)

With these the problem header is a one-liner

`\prob@heading` We consolidate the problem header line into a separate internal macro that can be reused in various settings.

```

8260 \def\prob@heading{
8261   {\prob@problem@kw}\ \prob@number\prob@title{~}{~}{~}\strut}
8262   %\sref@label@id{\prob@problem@kw~\prob@number}{~}
8263 }

```

(End definition for `\prob@heading`. This function is documented on page ??.)

With this in place, we can now define the `problem` environment. It comes in two shapes, depending on whether we are in boxed mode or not. In both cases we increment the problem number and output the points and minutes (depending) on whether the respective options are set.

`sproblem (env.)`

```

8264 \newenvironment{sproblem}[1][]{
8265   \__problems_prob_args:n{#1}%\sref@target%
8266   \@in@omtexttrue% we are in a statement (for inline definitions)
8267   \refstepcounter{sproblem}\record@problem
8268   \def\current@section@level{\prob@problem@kw}
8269
8270   \str_if_empty:NT \l__problems_prob_name_str {
8271     \seq_get_right:NN \g_stex_currentfile_seq \l_tmpa_str
8272     \seq_set_split:NnV \l_tmpa_seq . \l_tmpa_str
8273     \seq_get_left:NN \l_tmpa_seq \l__problems_prob_name_str
8274   }
8275
8276   \stex_if_do_html:T{
8277     \tl_if_empty:NF \l__problems_prob_title_tl {
8278       \exp_args:No \stex_document_title:n \l__problems_prob_title_tl
8279     }
8280   }
8281
8282   \exp_args:Nno\stex_module_setup:nn{type=problem}\l__problems_prob_name_str
8283
8284   \stex_reactivate_macro:N \STEXexport
8285   \stex_reactivate_macro:N \importmodule

```

```

8286 \stex_reactivate_macro:N \symdecl
8287 \stex_reactivate_macro:N \notation
8288 \stex_reactivate_macro:N \symdef
8289
8290 \stex_if_do_html:T{
8291   \begin{stex_annotate_env} {problem} {
8292     \l_stex_module_ns_str ? \l_stex_module_name_str
8293   }
8294
8295   \stex_annotate_invisible:nnn{header}{} {
8296     \stex_annotate:nnn{language}{ \l_stex_module_lang_str }{}
8297     \stex_annotate:nnn{signature}{ \l_stex_module_sig_str }{}
8298     \str_if_eq:VnF \l_stex_module_meta_str {NONE} {
8299       \stex_annotate:nnn{metatheory}{ \l_stex_module_meta_str }{}
8300     }
8301   }
8302 }
8303
8304 \stex_csl_to_imports:No \importmodule \l__problems_prob_imports_tl
8305
8306
8307 \tl_if_exist:NTF \l__problems_inclprob_type_tl {
8308   \tl_set_eq:NN \sproblemtype \l__problems_inclprob_type_tl
8309 }{
8310   \tl_set_eq:NN \sproblemtype \l__problems_prob_type_tl
8311 }
8312 \str_if_exist:NTF \l__problems_inclprob_id_str {
8313   \str_set_eq:NN \sproblemid \l__problems_inclprob_id_str
8314 }{
8315   \str_set_eq:NN \sproblemid \l__problems_prob_id_str
8316 }
8317
8318
8319 \stex_if_smsmode:F {
8320   \clist_set:No \l_tmpa_clist \sproblemtype
8321   \tl_clear:N \l_tmpa_tl
8322   \clist_map_inline:Nn \l_tmpa_clist {
8323     \tl_if_exist:cT {__problems_sproblem_##1_start:}{
8324       \tl_set:Nn \l_tmpa_tl {\use:c{__problems_sproblem_##1_start:}}
8325     }
8326   }
8327   \tl_if_empty:NTF \l_tmpa_tl {
8328     \__problems_sproblem_start:
8329   }{
8330     \l_tmpa_tl
8331   }
8332 }
8333 \stex_ref_new_doc_target:n \sproblemid
8334 \stex_if_smsmode:TF \stex_smsmode_do: \ignorespacesandpars
8335 }{
8336   \__stex_modules_end_module:
8337   \stex_if_smsmode:F{
8338     \clist_set:No \l_tmpa_clist \sproblemtype
8339     \tl_clear:N \l_tmpa_tl

```

```

8340 \clist_map_inline:Nn \l_tmpa_clist {
8341 \tl_if_exist:cT {__problems_sproblem_##1_end:}{
8342 \tl_set:Nn \l_tmpa_tl {\use:c{__problems_sproblem_##1_end:}}
8343 }
8344 }
8345 \tl_if_empty:NTF \l_tmpa_tl {
8346 \__problems_sproblem_end:
8347 }{
8348 \l_tmpa_tl
8349 }
8350 }
8351 \stex_if_do_html:T{
8352 \end{stex_annotate_env}
8353 }
8354
8355 \smallskip
8356 }
8357
8358 \seq_put_right:Nx\g_stex_smsmode_allowedenvs_seq{\tl_to_str:n{sproblem}}
8359
8360
8361
8362 \cs_new_protected:Nn \__problems_sproblem_start: {
8363 \par\noindent\textbf{\prob@heading\show@pts\show@min\\ignorespacesandpars
8364 }
8365 \cs_new_protected:Nn \__problems_sproblem_end: {\par\smallskip}
8366
8367 \newcommand\stexpatchproblem[3][] {
8368 \str_set:Nx \l_tmpa_str{ #1 }
8369 \str_if_empty:NTF \l_tmpa_str {
8370 \tl_set:Nn \__problems_sproblem_start: { #2 }
8371 \tl_set:Nn \__problems_sproblem_end: { #3 }
8372 }{
8373 \exp_after:wN \tl_set:Nn \csname __problems_sproblem_#1_start:\endcsname{ #2 }
8374 \exp_after:wN \tl_set:Nn \csname __problems_sproblem_#1_end:\endcsname{ #3 }
8375 }
8376 }
8377
8378
8379 \bool_if:NT \c__problems_boxed_bool {
8380 \surroundwithmdframed{problem}
8381 }

```

\record@problem This macro records information about the problems in the *.aux file.

```

8382 \def\record@problem{
8383 \protected@write\@auxout{}
8384 {
8385 \string\@problem{\prob@number}
8386 {
8387 \tl_if_exist:NTF \l__problems_inclprob_pts_tl {
8388 \l__problems_inclprob_pts_tl
8389 }{
8390 \l__problems_prob_pts_tl
8391 }

```

```

8392 }%
8393 {
8394   \tl_if_exist:NTF \l__problems_inclprob_min_tl {
8395     \l__problems_inclprob_min_tl
8396   }{
8397     \l__problems_prob_min_tl
8398   }
8399 }
8400 }
8401 }

```

(End definition for `\record@problem`. This function is documented on page ??.)

`\@problem` This macro acts on a problem's record in the `*.aux` file. It does not have any functionality here, but can be redefined elsewhere (e.g. in the `assignment` package).

```

8402 \def\@problem#1#2#3{}

```

(End definition for `\@problem`. This function is documented on page ??.)

`solution (env.)` The `solution` environment is similar to the `problem` environment, only that it is independent of the boxed mode. It also has it's own keys that we need to define first.

```

8403 \keys_define:nn { problem / solution }{
8404   id          .str_set_x:N = \l__problems_solution_id_str ,
8405   for         .str_set_x:N = \l__problems_solution_for_str ,
8406   type       .str_set_x:N = \l__problems_solution_type_str ,
8407   title      .tl_set:N     = \l__problems_solution_title_tl
8408 }
8409 \cs_new_protected:Nn \__problems_solution_args:n {
8410   \str_clear:N \l__problems_solution_id_str
8411   \str_clear:N \l__problems_solution_type_str
8412   \str_clear:N \l__problems_solution_for_str
8413   \tl_clear:N \l__problems_solution_title_tl
8414   \keys_set:nn { problem / solution }{ #1 }
8415 }

```

`\startsolutions` for the `\startsolutions` macro we use the `\specialcomment` macro from the `comment` package. Note that we use the `\@startsolution` macro in the start codes, that parses the optional argument.

```

8416 \box_new:N \l__problems_solution_box
8417 \newenvironment{solution}[1][{}]{
8418   \__problems_solution_args:n{#1}
8419   \stex_html_backend:TF{
8420     \stex_if_do_html:T{
8421       \begin{stex_annotate_env}{solution}{}
8422       \str_if_empty:NF \l__problems_solution_type_str {
8423         \par\noindent
8424         \stex_annotate_invisible:nnn{typestrings}{\sexampletype}{}
8425       }
8426       \noindent\textbf{Solution}\tl_if_empty:NF\l__problems_solution_title_tl{~(\l__problem
8427     }
8428   }{
8429     \setbox\l__problems_solution_box\vbox\bgroup
8430     \par\smallskip\hrule\smallskip
8431     \noindent\textbf{Solution}\tl_if_empty:NF\l__problems_solution_title_tl{~(\l__problems
8432   }

```

```

8433 }{
8434   \stex_html_backend:TF{
8435     \stex_if_do_html:T{
8436       \end{stex_annotate_env}
8437     }
8438   }{
8439     \smallskip\hrule
8440     \egroup
8441     \bool_if:NT \c__problems_solutions_bool {
8442       \strut\par\noindent
8443       \box\l__problems_solution_box
8444     }
8445   }
8446 }
8447
8448 \newcommand\startsolutions{
8449   \bool_set_true:N \c__problems_solutions_bool
8450   \solutionstrue
8451   % \specialcomment{solution}{\@startsolution}{
8452   %   \bool_if:NF \c__problems_boxed_bool {
8453   %     \hrule\medskip
8454   %   }
8455   %   \end{small}}%
8456   % }
8457   % \bool_if:NT \c__problems_boxed_bool {
8458   %   \surroundwithmdframed{solution}
8459   % }
8460 }

```

(End definition for \startsolutions. This function is documented on page 68.)

\stopsolutions

```

8461 \newcommand\stopsolutions{\bool_set_false:N \c__problems_solutions_bool \solutionsfalse}%\ex

```

(End definition for \stopsolutions. This function is documented on page 68.)

exnote (env.)

```

8462 \bool_if:NTF \c__problems_notes_bool {
8463   \newenvironment{exnote}[1][]{
8464     \par\smallskip\hrule\smallskip
8465     \noindent\textbf{\prob@note@kw :~ }\small
8466   }{
8467     \smallskip\hrule
8468   }
8469 }{
8470   \excludacomment{exnote}
8471 }

```

hint (env.)

```

8472 \bool_if:NTF \c__problems_notes_bool {
8473   \newenvironment{hint}[1][]{
8474     \par\smallskip\hrule\smallskip
8475     \noindent\textbf{\prob@hint@kw :~ }\small
8476   }{

```

```

8477 \smallskip\hrule
8478 }
8479 \newenvironment{exhint}[1][{}{
8480 \par\smallskip\hrule\smallskip
8481 \noindent\textbf{\prob@hint@kw :~ }\small
8482 }{
8483 \smallskip\hrule
8484 }
8485 }{
8486 \excludecomment{hint}
8487 \excludecomment{exhint}
8488 }

```

gnote (*env.*)

```

8489 \bool_if:NTF \c__problems_notes_bool {
8490 \newenvironment{gnote}[1][{}{
8491 \par\smallskip\hrule\smallskip
8492 \noindent\textbf{\prob@gnote@kw :~ }\small
8493 }{
8494 \smallskip\hrule
8495 }
8496 }{
8497 \excludecomment{gnote}
8498 }

```

41.3 Markup for Added Value Services

41.4 Multiple Choice Blocks

EdN:12

mcb (*env.*)¹²

```

8499 \newenvironment{mcb}{
8500 \begin{enumerate}
8501 }{
8502 \end{enumerate}
8503 }

```

we define the keys for the mcb macro

```

8504 \cs_new_protected:Nn \__problems_do_yes_param:Nn {
8505 \exp_args:Nx \str_if_eq:nnTF { \str_lowercase:n{ #2 } }{ yes }{
8506 \bool_set_true:N #1
8507 }{
8508 \bool_set_false:N #1
8509 }
8510 }
8511 \keys_define:nn { problem / mcb }{
8512 id .str_set_x:N = \l__problems_mcc_id_str ,
8513 feedback .tl_set:N = \l__problems_mcc_feedback_tl ,
8514 T .default:n = { false } ,
8515 T .bool_set:N = \l__problems_mcc_t_bool ,
8516 F .default:n = { false } ,

```

¹²EdNOTE: MK: maybe import something better here from a dedicated MC package

```

8517 F      .bool_set:N    = \l__problems_mcc_f_bool ,
8518 Ttext   .tl_set:N     = \l__problems_mcc_Ttext_tl ,
8519 Ftext   .tl_set:N     = \l__problems_mcc_Ftext_tl
8520 }
8521 \cs_new_protected:Nn \l__problems_mcc_args:n {
8522   \str_clear:N \l__problems_mcc_id_str
8523   \tl_clear:N \l__problems_mcc_feedback_tl
8524   \bool_set_false:N \l__problems_mcc_t_bool
8525   \bool_set_false:N \l__problems_mcc_f_bool
8526   \tl_clear:N \l__problems_mcc_Ttext_tl
8527   \tl_clear:N \l__problems_mcc_Ftext_tl
8528   \str_clear:N \l__problems_mcc_id_str
8529   \keys_set:nn { problem / mcc }{ #1 }
8530 }

```

\mcc

```

8531 \def\mccTrueText{\textbf{\prob@correct@kw!~}}
8532 \def\mccFalseText{\textbf{\prob@wrong@kw!~}}
8533 \newcommand\mcc[2][] {
8534   \l__problems_mcc_args:n{ #1 }
8535   \item[{$\Box$}] #2
8536   \bool_if:NT \c__problems_solutions_bool {
8537     \
8538     \bool_if:NT \l__problems_mcc_t_bool {
8539       \tl_if_empty:NTF\l__problems_mcc_Ttext_tl\mccTrueText\l__problems_mcc_Ttext_tl
8540     }
8541     \bool_if:NT \l__problems_mcc_f_bool {
8542       \tl_if_empty:NTF\l__problems_mcc_Ttext_tl\mccFalseText\l__problems_mcc_Ftext_tl
8543     }
8544     \tl_if_empty:NF \l__problems_mcc_feedback_tl {
8545       \emph{\l__problems_mcc_feedback_tl}
8546     }
8547   }
8548 } %solutions

```

(End definition for \mcc. This function is documented on page 69.)

41.5 Filling in Concrete Solutions

\includeproblem This is embarrassingly simple, but can grow over time.

```

8549 \newcommand\fillinsol[2][] {%
8550   \def\@test{#1}
8551   \quad%
8552   \ifsolutions\textcolor{red}{#1!}\else%
8553   \fbox{\ifx\@test\empty\phantom{\huge{21}}\else\hspace{#1}\fi}%
8554   \fi}

```

(End definition for \includeproblem. This function is documented on page 71.)

41.6 Including Problems

\includeproblem The `\includeproblem` command is essentially a glorified `\input` statement, it sets some internal macros first that overwrite the local points. Importantly, it resets the `inclprob` keys after the input.

```

8555 \keys_define:nn{ problem / inclproblem }{
8556   id      .str_set_x:N = \l__problems_inclprob_id_str,
8557   pts     .tl_set:N    = \l__problems_inclprob_pts_tl,
8558   min     .tl_set:N    = \l__problems_inclprob_min_tl,
8559   title   .tl_set:N    = \l__problems_inclprob_title_tl,
8560   refnum  .int_set:N    = \l__problems_inclprob_refnum_int,
8561   type    .tl_set:N    = \l__problems_inclprob_type_tl,
8562   mhrepos .str_set_x:N = \l__problems_inclprob_mhrepos_str
8563 }
8564
8565 \cs_new_protected:Nn \l__problems_inclprob_args:n {
8566   \str_clear:N \l__problems_prob_id_str
8567   \tl_clear:N \l__problems_inclprob_pts_tl
8568   \tl_clear:N \l__problems_inclprob_min_tl
8569   \tl_clear:N \l__problems_inclprob_title_tl
8570   \tl_clear:N \l__problems_inclprob_type_tl
8571   \int_zero_new:N \l__problems_inclprob_refnum_int
8572   \str_clear:N \l__problems_inclprob_mhrepos_str
8573   \keys_set:nn { problem / inclproblem }{ #1 }
8574   \tl_if_empty:NT \l__problems_inclprob_pts_tl {
8575     \let\l__problems_inclprob_pts_tl\undefined
8576   }
8577   \tl_if_empty:NT \l__problems_inclprob_min_tl {
8578     \let\l__problems_inclprob_min_tl\undefined
8579   }
8580   \tl_if_empty:NT \l__problems_inclprob_title_tl {
8581     \let\l__problems_inclprob_title_tl\undefined
8582   }
8583   \tl_if_empty:NT \l__problems_inclprob_type_tl {
8584     \let\l__problems_inclprob_type_tl\undefined
8585   }
8586   \int_compare:nNnT \l__problems_inclprob_refnum_int = 0 {
8587     \let\l__problems_inclprob_refnum_int\undefined
8588   }
8589 }
8590
8591 \cs_new_protected:Nn \l__problems_inclprob_clear: {
8592   \let\l__problems_inclprob_id_str\undefined
8593   \let\l__problems_inclprob_pts_tl\undefined
8594   \let\l__problems_inclprob_min_tl\undefined
8595   \let\l__problems_inclprob_title_tl\undefined
8596   \let\l__problems_inclprob_type_tl\undefined
8597   \let\l__problems_inclprob_refnum_int\undefined
8598   \let\l__problems_inclprob_mhrepos_str\undefined
8599 }
8600 \l__problems_inclprob_clear:
8601
8602 \newcommand\includeproblem[2][ ]{
8603   \l__problems_inclprob_args:n{ #1 }

```



```

8604 \exp_args:No \stex_in_repository:nn\l__problems_inclprob_mhrepos_str{
8605   \stex_html_backend:TF {
8606     \str_clear:N \l_tmpa_str
8607     \prop_get:NnNF \l_stex_current_repository_prop { narr } \l_tmpa_str {
8608       \prop_get:NnNF \l_stex_current_repository_prop { ns } \l_tmpa_str {}
8609     }
8610     \stex_annotate_invisible:nnn{includeproblem}{
8611       \l_tmpa_str / #2
8612     }{}
8613   }{
8614     \begingroup
8615     \inputreftrue
8616     \tl_if_empty:nTF{ ##1 }{
8617       \input{#2}
8618     }{
8619       \input{ \c_stex_mathhub_str / ##1 / source / #2 }
8620     }
8621     \endgroup
8622   }
8623 }
8624 \__problems_inclprob_clear:
8625 }

```

(End definition for `\includeproblem`. This function is documented on page 71.)

41.7 Reporting Metadata

For messages it is OK to have them in English as the whole documentation is, and we can therefore assume authors can deal with it.

```

8626 \AddToHook{enddocument}{
8627   \bool_if:NT \c__problems_pts_bool {
8628     \message{Total:~\arabic{pts}~points}
8629   }
8630   \bool_if:NT \c__problems_min_bool {
8631     \message{Total:~\arabic{min}~minutes}
8632   }
8633 }

```

The margin pars are reader-visible, so we need to translate

```

8634 \def\pts#1{
8635   \bool_if:NT \c__problems_pts_bool {
8636     \marginpar{#1~\prob@pt@kw}
8637   }
8638 }
8639 \def\min#1{
8640   \bool_if:NT \c__problems_min_bool {
8641     \marginpar{#1~\prob@min@kw}
8642   }
8643 }

```

`\show@pts` The `\show@pts` shows the points: if no points are given from the outside and also no points are given locally do nothing, else show and add. If there are outside points then we show them in the margin.

```

8644 \newcounter{pts}
8645 \def\show@pts{
8646   \tl_if_exist:NTF \l__problems_inclprob_pts_tl {
8647     \bool_if:NT \c__problems_pts_bool {
8648       \marginpar{\l__problems_inclprob_pts_tl\ \prob@pt@kw\smallskip}
8649       \addtocounter{pts}{\l__problems_inclprob_pts_tl}
8650     }
8651   }{
8652     \tl_if_exist:NT \l__problems_prob_pts_tl {
8653       \bool_if:NT \c__problems_pts_bool {
8654         \tl_if_empty:NT\l__problems_prob_pts_tl{
8655           \tl_set:Nn \l__problems_prob_pts_tl {0}
8656         }
8657         \marginpar{\l__problems_prob_pts_tl\ \prob@pt@kw\smallskip}
8658         \addtocounter{pts}{\l__problems_prob_pts_tl}
8659       }
8660     }
8661   }
8662 }

```

(End definition for \show@pts. This function is documented on page ??.)
and now the same for the minutes

\show@min

```

8663 \newcounter{min}
8664 \def\show@min{
8665   \tl_if_exist:NTF \l__problems_inclprob_min_tl {
8666     \bool_if:NT \c__problems_min_bool {
8667       \marginpar{\l__problems_inclprob_pts_tl\ min}
8668       \addtocounter{min}{\l__problems_inclprob_min_tl}
8669     }
8670   }{
8671     \tl_if_exist:NT \l__problems_prob_min_tl {
8672       \bool_if:NT \c__problems_min_bool {
8673         \tl_if_empty:NT\l__problems_prob_min_tl{
8674           \tl_set:Nn \l__problems_prob_min_tl {0}
8675         }
8676         \marginpar{\l__problems_prob_min_tl\ min}
8677         \addtocounter{min}{\l__problems_prob_min_tl}
8678       }
8679     }
8680   }
8681 }
8682 \</package>

```

(End definition for \show@min. This function is documented on page ??.)

41.8 Testing and Spacing

\testspace

```

8683 \newcommand\testspace[1]{\bool_if:NT \c__problems_boxed_bool {\vspace*{#1}}}

```

(End definition for \testspace. This function is documented on page ??.)

`\testnewpage`

```
8684 \newcommand\testnewpage{\bool_if:NT \c__problems_boxed_bool {\newpage}}
```

(End definition for \testnewpage. This function is documented on page ??.)

`\testemptypage`

```
8685 \newcommand\testemptypage[1] [] {%
```

```
8686 \bool_if:NT \c__problems_boxed_bool {\begin{center}\hwexam@testemptypage@kw\end{center}\vfil
```

(End definition for \testemptypage. This function is documented on page ??.)

`\test*space`

```
8687 \newcommand\testsmallspace{\testspace{1cm}}
```

```
8688 \newcommand\testmedspace{\testspace{2cm}}
```

```
8689 \newcommand\testbigspace{\testspace{3cm}}
```

*(End definition for \test*space. This function is documented on page ??.)*

Chapter 42

Implementation: The hwexam Package

42.1 Package Options

The first step is to declare (a few) package options that handle whether certain information is printed or not. Some come with their own conditionals that are set by the options, the rest is just passed on to the `problems` package.

```
8690 {*package}
8691 \ProvidesExplPackage{hwexam}{2022/09/14}{3.2.0}{homework assignments and exams}
8692 \RequirePackage{13keys2e}
8693
8694 \newif\iftest\testfalse
8695 \DeclareOption{test}{\testtrue\PassOptionsToPackage{\CurrentOption}{problem}}
8696 \newif\ifmultiple\multiplefalse
8697 \DeclareOption{multiple}{\multipletrue}
8698 \DeclareOption{lang}{\PassOptionsToPackage{\CurrentOption}{problem}}
8699 \DeclareOption*{\PassOptionsToPackage{\CurrentOption}{problem}}
8700 \ProcessOptions
```

Then we make sure that the necessary packages are loaded (in the right versions).

```
8701 \RequirePackage{keyval}[1997/11/10]
8702 \RequirePackage{problem}
```

`\hwexam@*@kw` For multilinguality, we define internal macros for keywords that can be specialized in `*.ldf` files.

```
8703 \newcommand\hwexam@assignment@kw{Assignment}
8704 \newcommand\hwexam@given@kw{Given}
8705 \newcommand\hwexam@due@kw{Due}
8706 \newcommand\hwexam@testemptypage@kw{This~page~was~intentionally~left~blank~for~extra~space}
8707 \newcommand\hwexam@minutes@kw{minutes}
8708 \newcommand\correction@probs@kw{prob.}
8709 \newcommand\correction@pts@kw{total}
8710 \newcommand\correction@reached@kw{reached}
8711 \newcommand\correction@sum@kw{Sum}
8712 \newcommand\correction@grade@kw{grade}
8713 \newcommand\correction@forgrading@kw{To~be~used~for~grading,~do~not~write~here}
```

(End definition for `\hwexam@*kw`. This function is documented on page ??.)

For the other languages, we set up triggers

```

8714 \AddToHook{begindocument}{
8715 \ltx@ifpackageloaded{babel}{
8716 \makeatletter
8717 \clist_set:Nx \l_tmpa_clist {\bbl@loaded}
8718 \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\detokenize{ngerman}}{
8719 \input{hwexam-ngerman.ldf}
8720 }
8721 \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\detokenize{finnish}}{
8722 \input{hwexam-finnish.ldf}
8723 }
8724 \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\detokenize{french}}{
8725 \input{hwexam-french.ldf}
8726 }
8727 \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\detokenize{russian}}{
8728 \input{hwexam-russian.ldf}
8729 }
8730 \makeatother
8731 }{}
8732 }
8733

```

42.2 Assignments

Then we set up a counter for problems and make the problem counter inherited from `problem.sty` depend on it. Furthermore, we specialize the `\prob@label` macro to take the assignment counter into account.

```

8734 \newcounter{assignment}
8735 %\numberproblemsin{assignment}

We will prepare the keyval support for the assignment environment.

8736 \keys_define:nn { hwexam / assignment } {
8737 id .str_set:N = \l_@@_assign_id_str,
8738 number .int_set:N = \l_@@_assign_number_int,
8739 title .tl_set:N = \l_@@_assign_title_tl,
8740 type .tl_set:N = \l_@@_assign_type_tl,
8741 given .tl_set:N = \l_@@_assign_given_tl,
8742 due .tl_set:N = \l_@@_assign_due_tl,
8743 loadmodules .code:n = {
8744 \bool_set_true:N \l_@@_assign_loadmodules_bool
8745 }
8746 }
8747 \cs_new_protected:Nn \_@@_assignment_args:n {
8748 \str_clear:N \l_@@_assign_id_str
8749 \int_set:Nn \l_@@_assign_number_int {-1}
8750 \tl_clear:N \l_@@_assign_title_tl
8751 \tl_clear:N \l_@@_assign_type_tl
8752 \tl_clear:N \l_@@_assign_given_tl
8753 \tl_clear:N \l_@@_assign_due_tl
8754 \bool_set_false:N \l_@@_assign_loadmodules_bool
8755 \keys_set:nn { hwexam / assignment }{ #1 }
8756 }

```

The next three macros are intermediate functions that handle the case gracefully, where the respective token registers are undefined.

The `\given@due` macro prints information about the given and due status of the assignment. Its arguments specify the brackets.

```

8757 \newcommand\given@due[2]{
8758 \bool_lazy_all:nF {
8759 { \tl_if_empty_p:V \l_@@_inclasssign_given_tl }
8760 { \tl_if_empty_p:V \l_@@_assign_given_tl }
8761 { \tl_if_empty_p:V \l_@@_inclasssign_due_tl }
8762 { \tl_if_empty_p:V \l_@@_assign_due_tl }
8763 }{ #1 }
8764
8765 \tl_if_empty:NTF \l_@@_inclasssign_given_tl {
8766 \tl_if_empty:NF \l_@@_assign_given_tl {
8767 \hwexam@given@kw\xspace\l_@@_assign_given_tl
8768 }
8769 }{
8770 \hwexam@given@kw\xspace\l_@@_inclasssign_given_tl
8771 }
8772
8773 \bool_lazy_or:nnF {
8774 \bool_lazy_and_p:nn {
8775 \tl_if_empty_p:V \l_@@_inclasssign_due_tl
8776 }{
8777 \tl_if_empty_p:V \l_@@_assign_due_tl
8778 }
8779 }{
8780 \bool_lazy_and_p:nn {
8781 \tl_if_empty_p:V \l_@@_inclasssign_due_tl
8782 }{
8783 \tl_if_empty_p:V \l_@@_assign_due_tl
8784 }
8785 }{ ,~ }
8786
8787 \tl_if_empty:NTF \l_@@_inclasssign_due_tl {
8788 \tl_if_empty:NF \l_@@_assign_due_tl {
8789 \hwexam@due@kw\xspace \l_@@_assign_due_tl
8790 }
8791 }{
8792 \hwexam@due@kw\xspace \l_@@_inclasssign_due_tl
8793 }
8794
8795 \bool_lazy_all:nF {
8796 { \tl_if_empty_p:V \l_@@_inclasssign_given_tl }
8797 { \tl_if_empty_p:V \l_@@_assign_given_tl }
8798 { \tl_if_empty_p:V \l_@@_inclasssign_due_tl }
8799 { \tl_if_empty_p:V \l_@@_assign_due_tl }
8800 }{ #2 }
8801 }

```

`\assignment@title` This macro prints the title of an assignment, the local title is overwritten, if there is one from the `\inputassignment`. `\assignment@title` takes three arguments the first is the

fallback when no title is given at all, the second and third go around the title, if one is given.

```

8802 \newcommand\assignment@title[3]{
8803 \tl_if_empty:NTF \l_@@_inclasssign_title_tl {
8804 \tl_if_empty:NTF \l_@@_assign_title_tl {
8805 #1
8806 }{
8807 #2\l_@@_assign_title_tl#3
8808 }
8809 }{
8810 #2\l_@@_inclasssign_title_tl#3
8811 }
8812 }

```

(End definition for \assignment@title. This function is documented on page ??.)

\assignment@number Like \assignment@title only for the number, and no around part.

```

8813 \newcommand\assignment@number{
8814 \int_compare:nNnTF \l_@@_inclasssign_number_int = {-1} {
8815 \int_compare:nNnTF \l_@@_assign_number_int = {-1} {
8816 \arabic{assignment}
8817 } {
8818 \int_use:N \l_@@_assign_number_int
8819 }
8820 }{
8821 \int_use:N \l_@@_inclasssign_number_int
8822 }
8823 }

```

(End definition for \assignment@number. This function is documented on page ??.)

With them, we can define the central **assignment** environment. This has two forms (separated by \ifmultiple) in one we make a title block for an assignment sheet, and in the other we make a section heading and add it to the table of contents. We first define an assignment counter

assignment (env.) For the **assignment** environment we delegate the work to the **@assignment** environment that depends on whether **multiple** option is given.

```

8824 \newenvironment{assignment}[1][]{
8825 \_@@_assignment_args:n { #1 }
8826 %\sref@target
8827 \int_compare:nNnTF \l_@@_assign_number_int = {-1} {
8828 \global\stepcounter{assignment}
8829 }{
8830 \global\setcounter{assignment}{\int_use:N\l_@@_assign_number_int}
8831 }
8832 \setcounter{sproblem}{0}
8833 \renewcommand\prob@label[1]{\assignment@number.##1}
8834 \def\current@section@level{\document@hwexamtype}
8835 %\sref@label{id}{\document@hwexamtype \thesection}
8836 \begin{@assignment}
8837 }{
8838 \end{@assignment}
8839 }

```

In the multi-assignment case we just use the omdoc environment for suitable sectioning.

```

8840 \def\ass@title{
8841 {\protect\document@hwexamtype}\arabic{assignment}
8842 \assignment@title{}\{;\}\{;\} -- \given@due{}\{;\}
8843 }
8844 \ifmultiple
8845 \newenvironment{@assignment}{
8846 \bool_if:NTF \l_@@_assign_loadmodules_bool {
8847 \begin{sfragment}[loadmodules]{\ass@title}
8848 }{
8849 \begin{sfragment}{\ass@title}
8850 }
8851 }{
8852 \end{sfragment}
8853 }

```

for the single-page case we make a title block from the same components.

```

8854 \else
8855 \newenvironment{@assignment}{
8856 \begin{center}\bf
8857 \Large@title\strut\
8858 \document@hwexamtype\arabic{assignment}\assignment@title{}\{;\}\{;\}\{;\}
8859 \large\given@due{--;\}\{;\}--}
8860 \end{center}
8861 }{}
8862 \fi% multiple

```

42.3 Including Assignments

\in*assignment This macro is essentially a glorified `\include` statement, it just sets some internal macros first that overwrite the local points. Importantly, it resets the `inclassig` keys after the input.

```

8863 \keys_define:nn { hwexam / inclassignment } {
8864 %id .str_set_x:N = \l_@@_assign_id_str,
8865 number .int_set:N = \l_@@_inclassign_number_int,
8866 title .tl_set:N = \l_@@_inclassign_title_tl,
8867 type .tl_set:N = \l_@@_inclassign_type_tl,
8868 given .tl_set:N = \l_@@_inclassign_given_tl,
8869 due .tl_set:N = \l_@@_inclassign_due_tl,
8870 mhrepos .str_set_x:N = \l_@@_inclassign_mhrepos_str
8871 }
8872 \cs_new_protected:Nn \_@@_inclassignment_args:n {
8873 \int_set:Nn \l_@@_inclassign_number_int {-1}
8874 \tl_clear:N \l_@@_inclassign_title_tl
8875 \tl_clear:N \l_@@_inclassign_type_tl
8876 \tl_clear:N \l_@@_inclassign_given_tl
8877 \tl_clear:N \l_@@_inclassign_due_tl
8878 \str_clear:N \l_@@_inclassign_mhrepos_str
8879 \keys_set:nn { hwexam / inclassignment }{ #1 }
8880 }
8881 \_@@_inclassignment_args:n {}
8882
8883 \newcommand\inputassignment[2][{}]{

```



```

8884 \_@@_inclassignment_args:n { #1 }
8885 \str_if_empty:NTF \l_@@_inclassign_mhrepos_str {
8886 \input{#2}
8887 }{
8888 \stex_in_repository:nn{\l_@@_inclassign_mhrepos_str}{
8889 \input{\mhpath{\l_@@_inclassign_mhrepos_str}{#2}}
8890 }
8891 }
8892 \_@@_inclassignment_args:n {}
8893 }
8894 \newcommand\includeassignment[2][]{
8895 \newpage
8896 \inputassignment[#1]{#2}
8897 }

```

(End definition for \in*assignment. This function is documented on page ??.)

42.4 Typesetting Exams

\quizheading

```

8898 \ExplSyntaxOff
8899 \newcommand\quizheading[1]{%
8900 \def\@tas{#1}%
8901 \large\noindent NAME: \hspace{8cm} MAILBOX:\[2ex]%
8902 \ifx\@tas\@empty\else%
8903 \noindent TA:~\@for\@I:=\@tas\do{{\Large$\Box$}\@I\hspace*{1em}}\[2ex]%
8904 \fi%
8905 }
8906 \ExplSyntaxOn

```

(End definition for \quizheading. This function is documented on page ??.)

\testheading

```

8907
8908 \def\hwexamheader{\input{hwexam-default.header}}
8909
8910 \def\hwexamminutes{
8911 \tl_if_empty:NTF \testheading@duration {
8912 {\testheading@min}~\hwexam@minutes@kw
8913 }{
8914 \testheading@duration
8915 }
8916 }
8917
8918 \keys_define:nn { hwexam / testheading } {
8919 min .tl_set:N = \testheading@min,
8920 duration .tl_set:N = \testheading@duration,
8921 reqpts .tl_set:N = \testheading@reqpts,
8922 tools .tl_set:N = \testheading@tools
8923 }
8924 \cs_new_protected:Nn \_@@_testheading_args:n {
8925 \tl_clear:N \testheading@min
8926 \tl_clear:N \testheading@duration

```

```

8927 \tl_clear:N \testheading@reqpts
8928 \tl_clear:N \testheading@tools
8929 \keys_set:nn { hwexam / testheading }{ #1 }
8930 }
8931 \newenvironment{testheading}[1][ ]{
8932 \_@@_testheading_args:n{ #1 }
8933 \newcount\check@time\check@time=\testheading@min
8934 \advance\check@time by -\theassignment@totalmin
8935 \newif\if@bonuspoints
8936 \tl_if_empty:NTF \testheading@reqpts {
8937 \@bonuspointsfalse
8938 }{
8939 \newcount\bonus@pts
8940 \bonus@pts=\theassignment@totalpts
8941 \advance\bonus@pts by -\testheading@reqpts
8942 \edef\bonus@pts{\the\bonus@pts}
8943 \@bonuspointstrue
8944 }
8945 \edef\check@time{\the\check@time}
8946
8947 \makeatletter\hwexamheader\makeatother
8948 }{
8949 \newpage
8950 }

```

(End definition for \testheading. This function is documented on page ??.)

\@problem This macro acts on a problem's record in the *.aux file. Here we redefine it (it was defined to do nothing in problem.sty) to generate the correction table.

```

8951 <@@=problems>
8952 \renewcommand\@problem[3]{
8953 \stepcounter{assignment@probs}
8954 \def\__problemspts{#2}
8955 \ifx\__problemspts\empty\else
8956 \addtocounter{assignment@totalpts}{#2}
8957 \fi
8958 \def\__problemsmin{#3}\ifx\__problemsmin\empty\else\addtocounter{assignment@totalmin}{#3}\fi
8959 \xdef\correction@probs{\correction@probs & #1}%
8960 \xdef\correction@pts{\correction@pts & #2}
8961 \xdef\correction@reached{\correction@reached &}
8962 }
8963 <@@=hwexam>

```

(End definition for \@problem. This function is documented on page ??.)

\correction@table This macro generates the correction table

```

8964 \newcounter{assignment@probs}
8965 \newcounter{assignment@totalpts}
8966 \newcounter{assignment@totalmin}
8967 \def\correction@probs{\correction@probs@kw}
8968 \def\correction@pts{\correction@pts@kw}
8969 \def\correction@reached{\correction@reached@kw}
8970 \stepcounter{assignment@probs}
8971 \newcommand\correction@table{

```

```

8972 \resizebox{\textwidth}{!}{%
8973 \begin{tabular}{|l|*{\theassignment@probs}{c|}|l|}\hline%
8974 &\multicolumn{\theassignment@probs}{c|}{%|
8975 {\footnotesize\correction@forgrading@kw} &\\ \hline
8976 \correction@probs & \correction@sum@kw & \correction@grade@kw\\ \hline
8977 \correction@pts & \theassignment@totalpts & \\ \hline
8978 \correction@reached & & \[.7cm]\hline
8979 \end{tabular}}
8980 \end{package}

```

(End definition for `\correction@table`. This function is documented on page ??.)

42.5 Leftovers

at some point, we may want to reactivate the logos font, then we use

```

here we define the logos that characterize the assignment
\font\bierfont=../assignments/bierglas
\font\denkerfont=../assignments/denker
\font\uhrfont=../assignments/uhr
\font\warnschildfont=../assignments/achtung

\newcommand\bierglas{{\bierfont\char65}}
\newcommand\denker{{\denkerfont\char65}}
\newcommand\uhr{{\uhrfont\char65}}
\newcommand\warnschild{{\warnschildfont\char 65}}
\newcommand\hardA{\warnschild}
\newcommand\longA{\uhr}
\newcommand\thinkA{\denker}
\newcommand\discussA{\bierglas}

```

Chapter 43

References

EdN:13

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- [Bus+04] Stephen Buswell et al. *The Open Math Standard, Version 2.0*. Tech. rep. The OpenMath Society, 2004. URL: <http://www.openmath.org/standard/om20>.
- [CR99] David Carlisle and Sebastian Rathz. *The graphicx package*. Part of the T_EX distribution. The Comprehensive T_EX Archive Network. 1999. URL: <https://www.tug.org/texlive/devsrc/Master/texmf-dist/doc/latex/graphics/graphics.pdf>.
- [DCM03] The DCMI Usage Board. *DCMI Metadata Terms*. DCMI Recommendation. Dublin Core Metadata Initiative, 2003. URL: <http://dublincore.org/documents/dcmi-terms/>.
- [Koh06] Michael Kohlhase. *OMDoc – An open markup format for mathematical documents [Version 1.2]*. LNAI 4180. Springer Verlag, Aug. 2006. URL: <http://omdoc.org/pubs/omdoc1.2.pdf>.
- [LMH] *LMH Scripts*. URL: <https://github.com/sLaTeX/lmhtools>.
- [MMT] *MMT – Language and System for the Uniform Representation of Knowledge*. Project web site. URL: <https://uniformal.github.io/> (visited on 01/15/2019).
- [MRK18] Dennis Müller, Florian Rabe, and Michael Kohlhase. “Theories as Types”. In: *9th International Joint Conference on Automated Reasoning*. Ed. by Didier Galmiche, Stephan Schulz, and Roberto Sebastiani. Springer Verlag, 2018. URL: <https://kwarc.info/kohlhase/papers/ijcar18-records.pdf>.
- [Rab15] Florian Rabe. “The Future of Logic: Foundation-Independence”. In: *Logica Universalis* 10.1 (2015). 10.1007/s11787-015-0132-x; Winner of the Contest “The Future of Logic” at the World Congress on Universal Logic, pp. 1–20.
- [RK13] Florian Rabe and Michael Kohlhase. “A Scalable Module System”. In: *Information & Computation* 0.230 (2013), pp. 1–54. URL: <https://kwarc.info/frabe/Research/mmt.pdf>.
- [RT] *sLaTeX/RusTeX*. URL: <https://github.com/sLaTeX/RusTeX> (visited on 04/22/2022).

¹³EdNOTE: we need an un-numbered version sfragment*

- [ST] *sTeX – An Infrastructure for Semantic Preloading of LaTeX Documents*. URL: <https://ctan.org/pkg/stex> (visited on 04/22/2022).
- [sTeX] *sTeX: A semantic Extension of TeX/LaTeX*. URL: <https://github.com/sLaTeX/sTeX> (visited on 05/11/2020).
- [Tana] Till Tantau. *beamer – A LaTeX class for producing presentations and slides*. URL: <http://ctan.org/pkg/beamer> (visited on 01/07/2014).
- [Tanb] Till Tantau. *User Guide to the Beamer Class*. URL: <http://ctan.org/macros/latex/contrib/beamer/doc/beameruserguide.pdf>.
- [TL] *TeX Live*. URL: <http://www.tug.org/texlive/> (visited on 12/11/2012).