The nChairX package

ChairX
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Abstract
This is a part of the new nChairX package providing the famous ChairX style.

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1 Introduction

This package defines the New ChairX style. Based on previous versions we provide a major clean-up with many additional features and easier handling. The style file is a rather high-level style file providing many standard environments needed in math, many macros needed in differential geometry, algebra, and analysis and some other useful tools. The style file includes several other packages and sets various defaults. There is a companion package called chairxmath which only defines the math-related macros but avoids setting environments etc.

2 Usage

To use the package you have to include it as usual by

\usepackage{nchairx}

and specify some options if needed.

2.1 Package Options

The math macros of the nchairx package can be excluded with the option nomath. This can be used if one does not need the math macros of nchairx and there occur clashes with other packages or macros, but the environments and other settings of nchairx are still desired.

2.2 Setting the Defaults

Being a rather high level package, several over-all styling options are set to new defaults. This includes several spacings, numbering schemes etc. Currently, the most important changes are the following:

- We redefine \mathbb to use the fonts from the bbm package, looks so much nicer: \( \mathbb{R} \) and \( \mathbb{C} \) but also \( k \).

- We redefine \mathcal to use the font EulerScript from the euler package yielding \( \mathcal{CO} \) and we define \mathsc to use the script font rsfs0 from the rsfs0 package giving \( \mathsc{ABC} \). Please make sure that these fonts are installed properly: with a recent \texttt{LaTeX}-installation this should be automatic.
• Equation numbers are always with sections in front. In the book class this leads to equation numbers having the chapter number and the section number in front.

• Displayed formulas are allowed to break over pages. As in mathematical texts one has many (many!) long formulas this is really necessary. Without allowing this by default a case by case decision typically leads to sub-optimal results in page breaks.

• We set \arraystretch to the value 1.2 to have a bit more space in arrays.

• The \left and the \right commands in math mode have a notoriously bad spacing. This is fixed by a hack from TeXExchange.

• The command \cleardoublepage will produce empty headers on an empty left page. This will only affect the behaviour in classes with left/right pages like the book class. It generally looks weird to have an empty left page containing just the page number or some default header but nothing else.

2.3 Supporting many Languages

For the use of other languages than English (our default) the options of the babel package are respected. The important keywords of nChairX (essentially the names of the environments) will then be translated accordingly. In order to enable this you have to load babel with the additional language you intend to use, e.g.

\usepackage[german,strings]{babel}

before you load nchairx. Currently, only German is supported beside English. Then you can switch between the languages inside one document with \selectlanguage{language} to get the correct names of the keywords. When loading several languages it is always a good idea to place an explicit \selectlanguage{language} at the beginning of the document to set the stage correctly. Note that you have to use the strings option for babel as well.

2.4 Environments

The nChairX package provides many predefined mathematical environments like definitions, theorems etc. The styling is fairly standard. The names of the environments are language sensitive based on the babel package.

2.4.1 The Predefined Environments

The following theorem-like environments will be defined as standards as they will be needed anyway. We use the ntheorem package to do this and load it automatically with several options. Hence you should not load it by hand with other options.

As usually needed we define the standard mathematical environments claim,
corollary, definition, lemma, proposition, and theorem with a common appearance: titles in bold, body in italic. The numbering will use a common counter including the section counter.

The environments conjecture, example, notation, question, and remark use the same counter as the above ones but have a body in roman.

The environment exercise has its own counter including the section and is set in roman.

We have a maintheorem environment which has no numbering at all: this is useful for papers where there is one and only one main theorem you want to place at a particular place, say in the introduction.

For all these environments there is a non-numbered version \texttt{nn<environment>}. So one can use e.g. \begin{nnmaintheorem} ... \end{nnmaintheorem} to get the theorem environment as above, but without numbering.

These environments are compatible with \texttt{autoref}. Hence using

\begin{verbatim}
\autoref{label_to_<env-name>}
\end{verbatim}

will give a linked reference to the environment labelled with

\begin{verbatim}
\label{label_to_<env-name>}
\end{verbatim}

with a prefix depending on the type of environment. This also works for chapters, sections, etc. For non-numbered environments one should still use \texttt{ref}.

We have a proof and a subproof environment with an automatic tombstone sign at their ends. The location of the tombstone signs is maintained by the \texttt{nt theorem} package in a really good way. The proof environment finishes with a box sign, the subproof with $\triangledown$. The only catch is that one should not use the commands $\[ \text{and} \] \]$ for equations without numbers in the proof environment anymore: this causes errors as soon as one wants to place a \texttt{tag{$*$}} for these equations. Instead, one can achieve this as follows:

\begin{verbatim}
\begin{equation*}
E = mc^2 \\
\tag{$*$}
\end{equation*}
\end{verbatim}

It seems that also some float environments (like figure or table) at the end of the proof confuse the \texttt{nt theorem} package; you should avoid this by placing the float outside of the proof environment.

We have a hint environment to be used inside exercises: set in a very small font and without numbering.

We have special list environments \texttt{claimlist}, \texttt{conjecturelist}, \texttt{conventionlist}, \texttt{corollarylist}, \texttt{definitionlist}, \texttt{examplelist}, \texttt{exerciselists}, \texttt{lemmalist}, \texttt{maintheoremlist}, \texttt{notationlist}, \texttt{propositionlist}, \texttt{questionlist}, \texttt{remarklist}, \texttt{remarklist}, \texttt{theoremlist} and \texttt{prooflist} corresponding to the above mathematical environments. They allow to control the appearance of the item lists individually. The items will be numbered in italic and can be referred to using the command \texttt{ref{item:MyLabel}}. Currently, all the lists are styled the same way, but this can individually be changed
easily. The lists are build using the `enumitem` package. You can use all options that are available by the `enumitem` package also for these lists.

```latex
\begin{itemize}
\item\texttt{cptenum}
\item\texttt{cptitem}
\item\texttt{cptdesc}
\end{itemize}
```

Beside these mathematical environments we also provide generic compact lists:

\begin{itemize}
\item\texttt{cptenum}, \texttt{cptitem}, and \texttt{cptdesc} similar to the lists from the `paralist` package.
\end{itemize}

### 2.5 Logo Support

The \texttt{nChairX} package provides two macros for your personal logo. With

\begin{itemize}
\item\texttt{nchairxheader}
\end{itemize}

you obtain a header logo with the full textwidth. It uses the file `nchairxheader.pdf` which has to be in your \TeX{} search path.

The other logo \texttt{nchairxlogo} is smaller and can be used with a specific width as argument. It includes the file `nchairxlogo.pdf` which has to be in the search path as well. The argument is the width in a valid \TeX{} unit producing e.g. \( M \cup \emptyset \).

### 3 The Math Macros

One of the main purposes of \texttt{nchairx} is to provide several (in fact, many) new math macros needed in various situations: we have support for many things in differential geometry, algebra, and functional analysis. The math macros can be used independently of the full \texttt{nchairx} package under the name \texttt{chairxmath}. However, \texttt{nchairx} always includes the math macros.

#### 3.1 The Handling of the Fonts

The package uses different fonts for different groups of macros. The font used for a particular macro is mentioned in the description of that macro. The groups of fonts are:

- \texttt{algebrafont} for generic algebras.
  - Can be accessed via \texttt{\algebra}.
  - Default font: \texttt{\mathsc}

- \texttt{basisfont} for bases of vector spaces.
  - Can be accessed via \texttt{\basis}.
  - Default font: \texttt{\mathit}

- \texttt{categoryfont} for generic categories.
  - Can be accessed via \texttt{\category}.
  - Default font: \texttt{\mathfrak}

- \texttt{categorynamefont} for predefined categories.
  - Can be accessed via \texttt{\categoryname}.
  - Default font: \texttt{\mathsf}
• \texttt{fieldfont} for generic fields.  
  Can be accessed via \texttt{\textbackslash field}.  
  Default font: \texttt{\textbackslash mathbb}  

• \texttt{filterfont} for generic filters.  
  Can be accessed via \texttt{\textbackslash filter}.  
  Default font: \texttt{\textbackslash mathfrak}  

• \texttt{functorfont} for generic functors.  
  Can be accessed via \texttt{\textbackslash functor}.  
  Default font: \texttt{\textbackslash mathsf}  

• \texttt{gerstenhaberfont} for generic Gerstenhaber algebras.  
  Can be accessed via \texttt{\textbackslash gerstenhaber}.  
  Default font: \texttt{\textbackslash mathfrak}  

• \texttt{groupfont} for the matrix groups.  
  Can be accessed via \texttt{\textbackslash group}.  
  Default font: \texttt{\textbackslash mathrm}  

• \texttt{groupoidfont} for generic groupoids.  
  Can be accessed via \texttt{\textbackslash groupoid}.  
  Default font: \texttt{\textbackslash mathfrak}  

• \texttt{hilbertfont} for Hilbert spaces.  
  Can be accessed via \texttt{\textbackslash hilbert}.  
  Default font: \texttt{\textbackslash mathfrak}  

• \texttt{liealgfont} for generic Lie algebras.  
  Can be accessed via \texttt{\textbackslash liealg}.  
  Default font: \texttt{\textbackslash mathfrak}  

• \texttt{modulefont} for generic modules.  
  Can be accessed via \texttt{\textbackslash module}.  
  Default font: \texttt{\textbackslash mathscr}  

• \texttt{prehilbfont} for pre-Hilbert space.  
  Can be accessed via \texttt{\textbackslash prehilb}.  
  Default font: \texttt{\textbackslash mathcal}  

• \texttt{operatorfont} for most common operators.  
  Can be accessed via \texttt{\textbackslash operator}.  
  Default font: \texttt{\textbackslash mathrm}  

• \texttt{ringfont} for generic rings.  
  Can be accessed via \texttt{\textbackslash ring}.  
  Default font: \texttt{\textbackslash mathsf}  

• \texttt{scriptfont} for subscripts.  
  Can be accessed via \texttt{\textbackslash script}.  
  Default font: \texttt{\textbackslash mathrm}
• sheaffont for generic sheaves. Can be accessed via \sheaf. Default font: \mathscr
• spacesfont for predefined function spaces, e.g. \Bounded. Default font: \mathscr
• topologyfont for generic topologies. Can be accessed via \topology. Default font: \mathscr

\chairxfonts The \chairxfonts macro can be used to redefine the fonts of the different groups of macros. It takes as argument a comma separated list of group names and the new font macros, e.g.
\chairxfonts{algebrafont = \mathfrak, scriptfont = \mathrm}

3.2 New Delimiter Sizes

We use \DeclarePairedDelimiters to generate all kind of bracket expressions of variable size as used e.g. in differential geometry. This has the big advantage that one has two options to set the size of the brackets: either with an explicit optional argument \big, \ldots, \Bigg, \vast, or \Vast like
\[
\text{Schouten}[\vast](X, Y): \left[ \begin{array}{c} X, Y \\ s \end{array} \right]
\]
or you can use the *-version which produces automatic sizes via \left and \right.
\[
\abs*{\lim\limits_{n\to\infty} b_n} \text{ yields } \left| \lim_{n\to\infty} b_n \right|
\]
Note, however, that this will typically result in sub-optimal spacing. Also, the brackets turn out to be typically too large.
Note that using the bracket constructions with \DeclarePairedDelimiters gives typically much better spacing than doing things by hand:
\[
\text{good } \abs{\det(A)}: |\det(A)| \quad \text{bad } \det(A): |\det(A)|
\]
\vast In many formulas one needs large delimiters typically ranging from \big to \Vast. However, in very large formula constructions even that is not enough.\vast
To have a systematic enlargement the following delimiters sizes are introduced:
\vastm, \vast, \Vastl, \Vastr, and \Vastm needed to define pairs of delimiters. They allow to produce large (pairs of) delimiters, always provided that the corresponding \Vastm font has the symbols in the correct size.
\vast The following commands allow for an option size argument:
• Absolute value \texttt{\textbackslash abs} \\
• Generic norm \texttt{\textbackslash norm} \\
• Supremum norm \texttt{\textbackslash supnorm} \\
• Essential supremum norm \texttt{\textbackslash essupnorm} \\
• Dirac ket \texttt{\textbackslash ket} \\
• Dirac bra \texttt{\textbackslash bra} \\
• Dirac ketbra \texttt{\textbackslash ketbra} \\
• Dirac braket \texttt{\textbackslash braket} \\
• Schouten bracket \texttt{\textbackslash Schouten} \\
• Nijenhuis-Richardson bracket \texttt{\textbackslash NRbracket} \\
• Frölicher-Nijenhuis bracket \texttt{\textbackslash FNbracket} \\
• Courant bracket \texttt{\textbackslash Courant} \\
• Dorfman bracket \texttt{\textbackslash Dorfman} \\
• Generic scalar product \texttt{\textbackslash SP} \\
• Generic inner product with decorations \texttt{\textbackslash IP} \\
• Restriction of a map \texttt{\textbackslash at} \\
• Étalé space of a presheaf \texttt{\textbackslash etale} \\

3.3 Decoration

We use the tensor package and modify things slightly to fit our needs: we provide a decoration command that allows to decorate arbitrary math symbols from left and right, top and bottom with other math symbols. This can be used to produce tensors with many indices. However, this is far too useful to be restricted to tensors only. The original \texttt{\textbackslash tensor} macro from the tensor package is still available under the name \texttt{\textbackslash originaltensor}. Note, that the \texttt{\textbackslash tensor} command in nchairx is intended for the symbol of tensor product, and not for decorating a symbol with indices.

\texttt{\textbackslash decorate} \hspace{1cm} \texttt{\textbackslash deco} \hspace{1cm} \texttt{\textbackslash etale}

Decorate a symbol from all sides. The option argument gives the decoration in front of the symbol, the first argument the symbol, the second (mandatory) argument the decoration after the symbol. For each decoration several superscripts and subscripts can be used like \texttt{\textbackslash decorate\{\textbackslash -\textbackslash a\_b\_c\}\{\textbackslash S\}\{\textbackslash _d\_\textbackslash r\_\textbackslash r\}\_\textbackslash e\}: \ a\_b\_c S\_d\_r\_e. \\

We also provide a simpler version of \texttt{\textbackslash decorate} called \texttt{\textbackslash deco} which takes five usual arguments and sets them as sub- and superscripts before and after the middle symbol \texttt{\textbackslash deco\{a\}\{b\}\{c\}\{d\}\{e\}}: \ a\_b\_c \_d\_e. This can be used to define your
own macros with decoration. E.g. for bimodules over rings one could define
\newcommand{\bimodule}[3]{\deco{}{\ring{#1}}{\module{#2}}{\ring{#3}}} which can then be used as \bimodule{R}{E}{S}.

\script
Sets the argument in the scriptfont and hence allows to create macros with fonts consistent with the \nchairx macros.

3.4 General Mathematics Macros

3.4.1 General Math Commands

\I Imaginary unit \i
\E Euler number \e
\D Differential \D x: dx
\cc Complex conjugation \mapsto \cc{z}: z \mapsto \overline{z}
\sign Signum \sign \sign{\sigma}
Uses operatorfont.
\RE Real part (the standard symbols are sooo ugly) \RE{z}: \text{Re}(z)
Uses operatorfont.
\IM Imaginary part \IM{z}: \text{Im}(z)
Uses operatorfont.
\Unit Unit element \Unit: \text{I}
\const Generic constant \const: \text{const}
Uses \mathit as font.
\canonical Subscript for canonical \omega_\canonical: \omega_{\text{can}}
Uses scriptfont.
\pt A single point \pt: \{pt\}
Uses operatorfont

3.4.2 Restrictions

\at Restriction of a map to a subset \at{U}: f\left|_U \right.
\at{\Big\{U\big)}}: \left. f\right|_U.
Default size is \big

3.4.3 Maps and Related Stuff

\Map Space of maps \Map{X, Y}: \text{Map}(X,Y)
Uses operatorfont.
\Bij Space of bijections \Bij{X, Y}: \text{Bij}(X,Y)
Uses operatorfont.
\argument Generic argument of a map \argument{f}: f(\cdot)
\domain Domain of a map \domain{\phi}: \text{dom}(\phi)
Uses operatorfont.
\range Range of a map \range{\phi}: \text{range}(\phi)
Uses operatorfont.
\id Identity map \id: \text{id}
Uses \texttt{operatorfont}.

- \texttt{\pr} Generic projection \( \pr: E \to M \)
- \texttt{\inv} Inversion map \( \inv: g \mapsto g^{-1} \)
- \texttt{\ev} Evaluation map \( \ev: V \otimes V^* \to \mathbb{k} \)
- \texttt{\image} Image of a map \( \image(f) \)
- \texttt{\graph} Graph of a map \( \graph(f) \)
- \texttt{\coimage} Coimage of a map \( \coimage(f) \)
- \texttt{\coker} Cokernel of a map \( \coker(f) \)
- \texttt{\operator} This macro allows to construct own mathematical operators whose fonts are consistent with the predefined operators of \texttt{nchairx \operator{asso}}:

3.4.4 Relations

- \texttt{\later} Later in a directed set \( i \succ j \)
- \texttt{\earlier} Earlier in a directed set \( i \prec j \)

3.4.5 Big Sums and Products

- \texttt{\bigplus} A big plus sign that can be decorated with limits. Similar to the usual sum it can be used inline \( \bigplus_{k=1}^{n} V_k \)

\[ \bigplus_{k=1}^{n} V_k \]

and in displaystyle:

\[ \bigplus_{k=1}^{n} V_k \]

- \texttt{\bigtimes} A big times sign that can be decorated with limits. Similar to the usual sum it can be used inline \( \bigtimes_{k=1}^{n} V_k \)

\[ \bigtimes_{k=1}^{n} V_k \]

and in displaystyle:

\[ \bigtimes_{k=1}^{n} V_k \]

- \texttt{\biprod} A biproduct sign that can be decorated with limits. Similar to the usual sum it can be used inline \( \biprod_{k=1}^{n} V_k \)

\[ \biprod_{k=1}^{n} V_k \]

and in displaystyle:

\[ \biprod_{k=1}^{n} V_k \]
3.4.6 Labels

In proofs we sometimes want to label an equation by a symbol and not by an equation number. Typical choices are of course \((\ast)\) or \((\ast\ast)\). But as proofs become longer, some additional labels are nice to have:

\begin{verbatim}
\smiley A smiley \smiley
\frownie A frownie \frownie
\heart A heart \heart
\end{verbatim}

3.5 Algebra

3.5.1 Fonts for Rings and Things

\begin{verbatim}
\field Font for rings \field{R}: R
Uses fieldfont.
\ring Font for rings \ring{C}: C
Uses ringfont.
\group Font for particular (matrix) groups \group{SO}(3): SO(3)
Uses groupfont.
\algebra Font for algebras \algebra{A}: sl
Uses algebrafont.
\module Font for modules \module{M}: M
Uses modulefont.
\liealg Font for Lie algebras \liealg{g}: g
Uses liealgfont.
\MC MC for Maurer-Cartan as a tiny index \MC \liealg{g}^{-1}: \mu_{MC} \in g^1
Uses scriptfont.
\gerstenhaber Font for Gerstenhaber algebras \gerstenhaber{G}: G
Uses gerstenhaberfont.
\end{verbatim}

3.5.2 Some Symbols needed in Algebra

\begin{verbatim}
\Pol Polynomials and polynomial functions \Pol(T^*Q): Pol(T^*Q)
Uses operatorfont.
\lmult Left multiplications \lmult_a: \ell_a
Uses operatorfont.
\rmult Right multiplications \rmult_b: \ell_b
Uses operatorfont.
\Lmult Left multiplications \Lmult_a: L_a
Uses operatorfont.
\Rmult Right multiplications \Rmult_b: R_b
Uses operatorfont.
\Center Center \Center(\algebra{A}): \mathfrak{T}(sl)
\ad Adjoint action (infinitesimal) \ad(a): ad(a)
Uses operatorfont.
\Ad Adjoint action \Ad_g: Ad_g
Uses operatorfont.
\end{verbatim}
Conjugation \(\Conj_g\): \(\Conj_g\)
Uses \texttt{operatorfont}.

\(\acts\) A generic (left) action map \(g \acts a \rightarrow g \cdot a\)
\(\racts\) A generic right action map \(a \racts g \rightarrow a \cdot g\)

\(\Char\) Characteristics of a field \(\Char(\mathbb{k})\): \(\text{char}(k)\)
Uses \texttt{operatorfont}.

\(\text{modulo}\) Yet another modulo \(n \text{ modulo } 2\)
Uses \texttt{operatorfont}.

\Clifford\ Clifford algebra generated by a vector space and a bilinear form: \(\Clifford(V, h)\)
Uses \texttt{operatorfont}.

\cClifford\ Complex Clifford algebra \(\cClifford(V, h)\)
Uses \texttt{operatorfont}.

\Der\ Derivations \(\Der(\algebra{A})\): \(\text{Der}(\mathcal{A})\)
\(\Der^*(\algebra{A})\): \(\text{\text{Der}^	op}(\mathcal{A})\)
Uses \texttt{operatorfont}.

\InnDer\ Inner (\text{\text{-})derivations} \(\InnDer(\algebra{A})\): \(\text{InnDer}(\mathcal{A})\)
\(\InnDer^*(\algebra{A})\): \(\text{\text{InnDer}^	op}(\mathcal{A})\)
Uses \texttt{operatorfont}.

\OutDer\ Outer (\text{\text{-})derivations} \(\OutDer(\algebra{A})\): \(\text{OutDer}(\mathcal{A})\)
\(\OutDer^*(\algebra{A})\): \(\text{\text{OutDer}^	op}(\mathcal{A})\)
Uses \texttt{operatorfont}.

\InnAut\ Inner (\text{\text{-})automorphisms} \(\InnAut(\algebra{A})\): \(\text{InnAut}(\mathcal{A})\)
\(\InnAut^*(\algebra{A})\): \(\text{\text{InnAut}^	op}(\mathcal{A})\)
Uses \texttt{operatorfont}.

\OutAut\ Outer (\text{\text{-})automorphisms} \(\OutAut(\algebra{A})\): \(\text{OutAut}(\mathcal{A})\)
\(\OutAut^*(\algebra{A})\): \(\text{\text{OutAut}^	op}(\mathcal{A})\)
Uses \texttt{operatorfont}.

\formal\ Formal power series in some variables \(V[\lambda] \equiv V\{\lambda\}\)
\laurent\ Formal Laurent series in some variables \(V(\lambda)\)

\sweedler\ Smaller index for Sweedler notation in Hopf algebra theory
\(\Delta(a) = a_1 \otimes a_2\)

3.5.3 Categories from Algebra

\algebras\ Category of algebras \(\algebras\)
Category of \text{-}algebras \(\algebras^*\): \(\text{-alg}\)
Uses \texttt{categorynamefont}.

\Algebras\ Category of unital algebras \(\Algebras\)
Category of unital \text{-}algebras \(\Algebras^*\): \(\text{-Alg}\)
Uses \texttt{categorynamefont}.

\reps\ Category of \text{-}representations \(\reps(\mathcal{A})\)
\(\text{-rep}(\mathcal{B})\)
Uses \texttt{categorynamefont}.

\Reps\ Category of strongly non-degenerate \(\mathcal{A}\) \text{-}representations \(\Reps(\mathcal{A})\)
\(\text{-Rep}(\mathcal{B})\)
Uses \texttt{categorynamefont}.
\Reps_* \algebra{A}(\algebra{B}) : \Rep_d(\mathcal{B})

Uses categorynamefont.

\PoissonAlg Category of (\ast)-Poisson algebras \PoissonAlg: \ast-PoissonAlg

Uses categorynamefont.

\modules Category of (inner product) modules \modules_\algebra{A}(\algebra{B}):
\mod_d(\mathcal{B})
\modules_* \algebra{A}(\algebra{B}): \ast\mod_d(\mathcal{B})

Uses categorynamefont.

\Leftmodules Category of left modules \Leftmodules\algebra{A}:
\mathcal{A}\mod

Uses categorynamefont.

\Rightmodules Category of right modules with optional subscript \Rightmodules[\category{C}]\algebra{A}:
\mathcal{A}\mod\category{C}

Uses categorynamefont.

\Modules Category of strongly non-degenerate (inner product) modules \Modules_\algebra{A}(\algebra{B}):
\Mod_d(\mathcal{B})
\Modules_* \algebra{A}(\algebra{B}):
\ast\Mod_d(\mathcal{B})

Uses categorynamefont.

\LeftModules Category of strongly non-degenerate left modules \LeftModules\algebra{A}:
\mathcal{A}\Mod

Uses categorynamefont.

\RightModules Category of strongly non-degenerate right modules with optional subscript
\RightModules[\category{C}]\algebra{A}:
\mathcal{A}\Mod\category{C}

Uses categorynamefont.

\Bimod Category of (inner product) bimodules \Bimod(\algebra{A},\algebra{B}):
\Bimod(\mathcal{A},\mathcal{B})
\Bimod_* \algebra{A}(\algebra{B}):
\ast\Bimod(\mathcal{A},\mathcal{B})

Uses categorynamefont.

\Rings Category of unital rings (meant to be associative) \Rings: Ring

Uses categorynamefont.

\Groups Category of groups \Groups: Group

Uses categorynamefont.

\Ab Category of abelian groups \Ab: Ab

Uses categorynamefont.

\Lattices Category of lattices \Lattices: Lattice

Uses categorynamefont.

\Sets Category of sets \Sets: Set

Uses categorynamefont.

\Vect Category of vector spaces \Vect: Vect

Uses categorynamefont.

\LieAlgs Category of Lie algebras \LieAlgs: LieAlg

Uses categorynamefont.

\Posets Category of partially ordered sets \Posets: Poset

Uses categorynamefont.

\Directed Category of directed sets \Directed: Directed
3.6 Analysis

3.6.1 General Analysis Macros

\vol Volume \vol: vol
Uses \texttt{operatorfont}
\complete Completion of some space \complete{V}: \hat{V}
\Ball Open ball \Ball_{r}(p): B_{r}(p)
\abs Generic absolute value \abs{x}: |x|
\norm Generic norm \norm{v}: \|v\|
\supnorm Supremum norm \supnorm{f}: ||f||_{\infty}
\expands Formal expansions f(t) \stackrel{t \to 0}{\expands} t^{k}
or with optional stretching factor (default is 2.5) a \expands[4] b: a \sim b.

3.6.2 Pseudodifferential Operators

\std Standard ordering as small subscript \sigma_{\std}: \sigma_{\std}
Uses \texttt{scriptfont}
\Weyl Weyl ordering as small subscript \sigma_{\Weyl}: \sigma_{\Weyl}
Uses \texttt{scriptfont}
\Op Operator for a symbol \Op(f): Op(f)
Uses \texttt{operatorfont}
\Opstd Standard ordered operator for a symbol \Opstd(f): Op_{\std}(f)
Uses \texttt{operatorfont}
\OpWeyl Weyl ordered operator for a symbol \OpWeyl(f): Op_{\Weyl}(f)
Uses \texttt{operatorfont}

3.6.3 Function Spaces

\spacename Font for specific functional spaces \spacename{F}(X): \mathcal{F}(X)
Uses \texttt{spacefont}.
\Bounded Bounded functions \Bounded(X): \mathcal{B}(X)
Uses \texttt{spacefont}.
\Continuous Continuous functions \Continuous(X): \mathcal{C}(X)
Uses \texttt{spacefont}.
\Contbound Continuous bounded functions \Contbound(X): \mathcal{C}_{b}(X)
Uses \texttt{spacefont}.
\Fun C^{k}-functions (for \mathcal{C} use \Continuous) \Fun(M): \mathcal{C}^{k}(M) and \Fun[\ell](M): \mathcal{C}_{\ell}(M)
Uses \texttt{spacefont}. 
\Cinfty Smooth functions $C^\infty(M)$

\Comega Real-analytic functions $C^\omega(M)$

\Holomorphic Holomorphic functions $\mathcal{O}(U)$

\AntiHolomorphic Anti-holomorphic functions $\mathcal{O}(U)$

\Schwartz Schwartz space $\mathcal{S}(\mathbb{R}^n)$

\Riemann Riemann integrable functions $\mathcal{R}([a, b])$

---

3.6.4 Locally Convex Analysis and Distributions

\singsupp Singular support of a distribution $\text{singsupp } u$: $\text{sing supp } u$

\seminorm Font for generic seminorm $\text{seminorm}(p)$: $p$

\ord Order of a distribution $\text{ord}(u)$: $\text{ord}(u)$

\conv Convex hull $\text{conv}(A)$: $\text{conv}(A)$

\extreme Extreme points $\text{extreme}(A)$: $\text{extreme}(A)$

---

3.6.5 Hilbert Spaces and Operators

\hilbert Font for Hilbert spaces $\text{hilbert}(H)$: $\mathcal{H}$

\prehilb Font for pre-Hilbert spaces $\text{prehilb}(H)$: $\mathcal{K}$

\Adjointable Adjointable operators $\text{Adjointable}(\text{hilbert}(H))$: $B(\mathcal{H})$ or with optional argument $\text{Adjointable}(\text{algebra}(A)\text{hilbert}(H))$: $B_A(\mathcal{H})$ if we have a Hilbert module over an algebra $A$ instead.

\Finite Finite rank operators $\text{Finite}(\text{hilbert}(H))$: $\mathcal{F}(\mathcal{H})$ or with optional argument $\text{Finite}(\text{algebra}(A)\text{hilbert}(H))$: $\mathcal{F}_A(\mathcal{H})$

\Compact Compact operators $\text{Compact}(\text{hilbert}(H))$: $\mathcal{K}(\mathcal{H})$ or with optional argument $\text{Compact}(\text{algebra}(A)\text{hilbert}(H))$: $\mathcal{K}_A(\mathcal{H})$

\opdomain Domain of definition of an operator $\text{opdomain}(A)$: $\mathcal{D}(A)$

\spec Spectrum of an operator $\text{spec}(A)$: $\text{spec}(A)$

\closure Closure of an operator $\text{closure}(A)$: $\overline{A}$

\res Resolvent set of an operator $\text{res}(A)$: $\text{res}(A)$

\Res Resolvent of an operator $\text{Res}_z(A)$: $\text{Res}_z(A)$

\specrad Spectral radius of an operator $\text{specrad}(A)$: $\rho(A)$

\slim Strong limit $\text{slim } n \rightarrow \infty A_n$: $\text{s-lim}_{n \rightarrow \infty} A_n$

\wlim Weak limit $\text{wlim } n \rightarrow \infty A_n$: $\text{w-lim}_{n \rightarrow \infty} A_n$
3.6.6 Dirac's Bra and Ket Notation

\[ \text{Dirac bra} \quad \langle \psi \rangle \]
\[ \text{Dirac ket} \quad \langle \phi | \]
\[ \text{Dirac bra-ket} \quad \langle \phi | \psi \rangle \]
\[ \text{Dirac ket-bra} \quad | \phi \rangle \langle \psi | \]

3.6.7 Operator Algebras

\[ \text{Spectrum of an algebra} \quad \text{Spec}(\mathcal{A}) \]
\[ \text{Radical of an algebra} \quad \text{Rad}(\mathcal{A}) \]
\[ \text{Fredholm index} \quad \text{ind}(\mathcal{A}) \]

3.6.8 Measure Theory and Integration

Here we need various function space of integrable functions (calligraphic ones) and the corresponding quotients by zero functions (roman ones):

\[ \text{Measurable functions} \quad \mathcal{M}(X) \]
\[ \text{Complex measures} \quad \mathcal{M}(X) = \mathcal{M}(X) \]
\[ \text{Bounded measurable functions} \quad \mathcal{B}(X) \]
\[ \text{Equivalence classes of } p \text{-integrable functions} \quad L^p(X) \]
\[ \text{Equivalence classes of } \ell^1 \text{-integrable functions} \quad \ell^1(X) \]
\[ \text{Equivalence classes of } L^2 \text{-integrable functions} \quad L^2(X) \]
\[ \text{Equivalence classes of essentially bounded functions} \quad L^\infty(X) \]
\[ \text{Space of } p \text{-integrable functions} \quad L^p(X) \]
\[ \text{Space of } \ell^1 \text{-integrable functions} \quad \ell^1(X) \]
\[ \text{Space of } L^2 \text{-integrable functions} \quad L^2(X) \]
\[ \text{Space of essentially bounded functions} \quad L^\infty(X) \]
\[ \text{Essential range} \quad \text{essrange}(f) \quad \text{essrange}(f) \]
\[ \text{Essential supremum} \quad \text{esssup}(f) \quad \text{esssup}(f) \]
\[ \text{Essential supremum norm} \quad \text{esssupnorm}(f) : \| f \|_{\text{esssup}} \]
\[ \text{Absolutely continuous part of a measure} \quad \mu_{\text{ac}} \quad \mu_{\text{ac}} \]
\[ \text{Singular part of a measure} \quad \mu_{\text{sing}} \quad \mu_{\text{sing}} \]
3.6.9 Limits

\texttt{\textbackslash indlim} Inductive (or direct) limit \( \texttt{\textbackslash indlim\{i \ in I\} A_i} \): \texttt{ind lim}_i \in I A_i

\texttt{\textbackslash projlim} Projective (or inverse) limit \( \texttt{\textbackslash projlim\{i \ in I\} A_i} \): \texttt{proj lim}_i \in I A_i

3.7 Category Theory

3.7.1 General Category Theory

\texttt{\textbackslash category} Font for generic categories \texttt{\textbackslash category\{C\}: \mathcal{C}}

\texttt{\textbackslash categoryname} Font for specific categories \texttt{\textbackslash categoryname\{FinSet\}: \textit{FinSet}}

\texttt{\textbackslash functor} Font for functors \texttt{\textbackslash functor\{F\}: F}

\texttt{\textbackslash groupoid} Font for groupoids \texttt{\textbackslash groupoid\{G\}: \mathcal{G}}

\texttt{\textbackslash source} Source of arrow \texttt{\textbackslash source\{f\}: source(f)}

\texttt{\textbackslash target} Target of arrow \texttt{\textbackslash target\{f\}: target(f)}

\texttt{\textbackslash unit} Unit map in groupoids \texttt{\textbackslash unit\{colon M \longrightarrow G\}}: unit: \texttt{M \to G}

\texttt{\textbackslash opp} Opposite category etc. \texttt{\textbackslash category\{C\}^-{\text{opp}}: \mathcal{C}^{\text{opp}}}

\texttt{\textbackslash asso} Natural transformation of associativity \texttt{\textbackslash asso: asso}

\texttt{\textbackslash Hom} Homomorphisms \texttt{\textbackslash Hom\{A, B\}: \text{Hom}(A, B)}

\texttt{\textbackslash End} Endomorphisms \texttt{\textbackslash End\{E\}: \text{End}(E)}

\texttt{\textbackslash Aut} \(\ast\)-Automorphisms \texttt{\textbackslash Aut\{A\}: \text{Aut}(A)}

\texttt{\textbackslash Iso} \(\ast\)-Isomorphisms \texttt{\textbackslash Iso\{A, B\}: \text{Iso}(A, B)}

\texttt{\textbackslash Obj} Objects of a category \texttt{\textbackslash Obj\{\textbackslash category\{C\}\}: \text{Obj}(\mathcal{C})}

\texttt{\textbackslash Morph} Morphisms of a category \texttt{\textbackslash Morph\{a, b\}: \text{Morph}(a, b)}

3.7.2 Colimits

\texttt{\textbackslash colim} Colimits of diagrams or functors: \texttt{\textbackslash colim \textbackslash functor\{F\}: colim F}
3.8 Differential Geometry

3.8.1 General Macros in Differential Geometry

\Lie Derivative \Lie_X f: \mathcal{L}_X f
\Schouten Schouten bracket \Schouten(X, Y): \mathcal{L}_X f
\Forms Differential forms \Forms(M): \Omega(M)
\ZdR DeRham cochains \ZdR(M, \mathbb{C})): Z_{dR}(M, \mathbb{C})
\EdR DeRham coboundaries \EdR(M, \mathbb{C})): B_{dR}(M, \mathbb{C})
\HdR DeRham cohomology \HdR(M, \mathbb{C})): H_{dR}(M, \mathbb{C})
\Diffeo Diffomorphism group \Diffeo(M): \text{Diffeo}(M)
\Diffop Differential operators \Diffop(M): \text{DiffOp}(M)
\loc To be used as an index \M\loc: M_{\text{loc}}
\germ Germs of functions \germ_p(f): \text{germ}_p(f)
\prol Prolongation map \prol(f): \text{prol}(f)
\NRbracket Nijenhuis-Richardson bracket \NRbracket(a, b): [a, b]_{NR}
\FNbracket Fröhlicher-Nijenhuis bracket \FNbracket(a, b): [a, b]_{FN}
\Manifolds The category of manifolds \Manifolds: \text{Manifold}

3.8.2 Lie Groups and Principal Fiber Bundles

\lefttriv Left trivialization \lefttriv: \text{left}
\righttriv Right trivialization \righttriv: \text{right}
\Gau Gauge group \Gau(P): \text{Gau}(P)
\Conn Connection one-forms \Conn(P): \text{Conn}(P)
\ratio Ratio map of principal fiber bundle \ratio(u, v): r(u, v)
\Parallel Parallel transport \Parallel_{0 \to 1, \gamma}(v): P_{0 \to 1, \gamma}(v)
\CE Chevalley-Eilenberg as index \CE: C_{\text{CE}}
\HCE Chevalley-Eilenberg cohomology \HCE(\liealg{g}): H_{\text{CE}}(g)
3.8.3 (Pseudo-) Riemannian Geometry

\nabla LC Levi-Civita covariant derivative \nabla \text{LC}_X Y: \nabla_X^\text{LC} Y
Uses \text{scriptfont}.

\Laplace Laplace operator \Laplace f: \Delta f

\dAlembert D'Alembert operator \dAlembert \ u: \Box \ u

\feynman Feynman slash notation \feynman D = \feynman A + \feynman \partial: \ D = A + \partial

\Dirac Dirac operator \Dirac \ u: \ D \ u

\rotation Rotation (i.e. curl) of a vector field \rotation(X): \text{rot}(X). \ Not \ to \ be \ confused
with \text{gr\ddot u}(X).
Uses \text{operatorfont}.

\curl Curl of a vector field \curl \vec{X}: \curl \vec{X}
Uses \text{operatorfont}.

\divergence Divergence of a vector field \divergence(X): \text{div}(X)
Uses \text{operatorfont}.

\gradient Gradient of a function \gradient f: \text{grad} f
Uses \text{operatorfont}.

\Tor Torsion of a covariant derivative \Tor(X, Y): \text{Tor}(X,Y)
Uses \text{operatorfont}.

\Ric Ricci curvature \Ric (X, Y): \text{Ric}(X,Y)
Uses \text{operatorfont}.

\scal Scalar curvature \scal: \scal


3.8.4 Complex Geometry

\Wijenhuis Nijenhuis operator \Wijenhuis(X, Y): Nij(X,Y)
Uses operatorfont.
\del Dolbeault operator \del \omega \in \Omega^{0,\bullet}(\omega)
\delbar CC of Dolbeault operator \delbar \alpha: \bar{\partial}\alpha
\FS Fubini Study as very small index \omega_{\FS}: \omega_{\FS}
Uses scriptfont.

3.8.5 Vector Bundles

\Lift Generic lift of something \nabla^Lift: \nabla^{Lift}
Uses scriptfont.
\ver Vertical lift \ver \omega: \omega^\ver
Uses scriptfont.
\hor Vertical subbundle \hor(E): \hor(E)
Uses operatorfont.
\Ver Horizontal subbundle \Ver(E): \Ver(E)
Uses operatorfont.
\Sec C^k-sections \Sec(E): \Gamma^k(E) and \Sec[2](E): \Gamma^2(E)
\Secinfty Smooth sections \Secinfty(E): \Gamma^\infty(E)
\HolSec Holomorphic sections \HolSec(U, E): \Gamma^{hol}(U, E)
Uses scriptfont.
\SymD Symmetrized covariant derivative \SymD^n f: D^n f
Uses operatorfont.
\Densities Densities of a vector bundle of rank n or specific rank \Densities TM: |\Lambda^n|T^*M
and \Densities[k] \Densities[k] \alpha E: |\Lambda^k|\alpha E.
\MeasurableSections Measurable sections \MeasurableSections(E): \mathcal{M}(E)
Uses spacefont.
\IntpSections L^p-integrable sections \IntpSections(Densities T^*M): L^p(M^{\Lambda^n}(\Lambda^n|T^*M))
or with optional argument \IntpSections[g](\Densities T^*M): L^g(M^{\Lambda^n}(\Lambda^n|T^*M)).
\IntegrableSections Integrable sections \IntegrableSections(Densities T^*M): L^1(M^{\Lambda^n}(\Lambda^n|T^*M))
\Translation Fiber translations \Translation_A: T_A
Uses operatorfont.
\frames Font for local frames \frames{e}_1, \ldots, \frames{e}_k: e_1, \ldots, e_k
Uses operatorfont.
Frame bundle of a vector bundle $\text{Frames}(E) \rightarrow M$.
Uses \texttt{operatorfont}.

Fiber derivative $\text{FDiff}$:
Uses \texttt{operatorfont}.

### 3.8.6 Symplectic and Poisson Geometry

Symplectomorphism group $\text{Sympl}(M, \omega)$.
Uses \texttt{groupfont}.

Jacobiator $\text{Jacobiator}$:
Uses \texttt{operatorfont}.

Reduced as an index $\text{red}$:
Uses \texttt{scriptfont}.

Hess map $\text{Hess}$:
Uses \texttt{operatorfont}.

KKS as tiny index $\{f, g\}_\text{KKS}$.
Uses \texttt{scriptfont}.

Courant bracket $\text{Courant}$:
Uses \texttt{scriptfont}.

Dorfman bracket $\text{Dorfman}$:
Uses \texttt{scriptfont}.

(Linear) Dirac structures $\text{Dir}$.
Uses \texttt{operatorfont}.

Forward map $\text{Forward}$:
Uses \texttt{operatorfont}.

Backward map $\text{Backward}$:
Uses \texttt{operatorfont}.

Generalized tangent bundle/map $\text{Tangent}$.

Marsden-Weinstein reduction $\text{MWreduction}$.
Uses \texttt{operatorfont}.

Monodromy groupoid $\text{Mon}$.
Uses \texttt{operatorfont}.

Holonomy groupoid $\text{Hol}$.
Uses \texttt{operatorfont}.

### 3.9 Linear Algebra

Trace of a linear map $\text{tr}$.
Uses \texttt{operatorfont}.

Rank of a linear map $\text{rank}$.
Uses \texttt{operatorfont}.

Codimension $\text{codim}$.
Uses \texttt{operatorfont}.

Diagonal $\text{diag}$.
Uses \texttt{operatorfont}.

Transposition of matrices $\text{Trans}$.
Uses \texttt{operatorfont}.

$\text{diag}(1,-1, -1)$.
Uses \texttt{operatorfont}.

$A^T$.
3.9.2 Tensors

\textbf{\textbackslash tensor} Generic tensor product over some ring a \textbf{\textbackslash tensor} b: \(a \otimes b\).
With optional subscript \(V\) \textbf{\textbackslash tensor} [\textbackslash algebra\{A\}] U: \(V \otimes_A U\).
\textbf{\textbackslash Tensor} Tensor powers, tensor algebra \textbf{\textbackslash Tensor} [\textbackslash bullet\{V\}]: \(T^V\).
\textbf{\textbackslash Anti} Antisymmetric tensor powers, Grassmann algebra \textbf{\textbackslash Anti\{V\}}: \(A(V)\).
\textbf{\textbackslash Sym} Symmetric tensor powers, symmetric algebra \textbf{\textbackslash Sym} [\textbackslash bullet\{V\}]: \(S(V)\).
\textbf{\textbackslash Symmetrizer} Symmetrizer \textbf{\textbackslash Symmetrizer} [\textbackslash n\{V\}]: \(\text{Sym}(V)\).
\textbf{\textbackslash AntiSymmetrizer} Anti-symmetrizer \textbf{\textbackslash AntiSymmetrizer} [\textbackslash n\{V\}]: \(\text{Alt}(V)\).
\textbf{\textbackslash ins} Generic insertion map \textbf{\textbackslash ins}\{X\}: \(i_X\).
\textbf{\textbackslash ins} Generic right insertion map \textbf{\textbackslash ins}\{X\}: \(j_X\).
\textbf{\textbackslash insa} Antisymmetric insertion map \textbf{\textbackslash insa}\{X\}: \(\text{insa}(X)\).
\textbf{\textbackslash insss} Symmetric insertion map \textbf{\textbackslash insss}\{X\}: \(\text{insss}(X)\).
\textbf{\textbackslash dega} Antisymmetric degree \(\text{deg a}(a) = ka: \deg a(a) = ka\).
\textbf{\textbackslash degs} Symmetric degree \(\text{deg s}(X) = \ell X: \deg s(X) = \ell X\).

3.9.3 Inner Products

\textbf{\textbackslash SP} Simple scalar product \textbf{\textbackslash SP}\{x, y\}: \langle x, y \rangle.
\textbf{\textbackslash littlepara} Small parallel to be used as a subscript \(v_\text{\littlepara}\).
\textbf{\textbackslash IP} Generic inner product with five arguments to decorate it \textbf{\textbackslash IP} [\textbackslash \{\ldots\}] and an optional argument to adjust the size:
\(B \langle z, w \rangle_R \downarrow \) and \(\langle \prod x_i, y \rangle_{\text{\littlepara}} \).

22
3.10 Statistics

3.10.1 Macros for General Statistics

\texttt{\textbackslash EX} Expectation value \texttt{\textbackslash EX\_\textbackslash omega(A)}: \( E_\omega(A) \)
Uses \texttt{operatorfont}.

\texttt{\textbackslash Var} Variance \texttt{\textbackslash Var(a)}: \texttt{\textbackslash Var(a)}
Uses \texttt{operatorfont}.

\texttt{\textbackslash Cov} Covariance \texttt{\textbackslash Cov\_\textbackslash omega(a, b)}: \texttt{\textbackslash Cov}_\omega(a, b)
Uses \texttt{operatorfont}.

\texttt{\textbackslash Cor} Correlation \texttt{\textbackslash Cor(a, b)}: \texttt{\textbackslash Cor(a, b)}
Uses \texttt{operatorfont}.

3.11 Topology

3.11.1 Macros for Topology

\texttt{\textbackslash cl} Topological closure \texttt{\textbackslash cl}: \texttt{X^{\textbackslash cl}}
Uses \texttt{scriptfont}.

\texttt{\textbackslash scl} Sequential closure \texttt{\textbackslash scl}: \texttt{A^{\textbackslash scl}}
Uses \texttt{scriptfont}.

\texttt{\textbackslash interior} Open interior \texttt{\textbackslash interior}: \texttt{A^\circ}
Uses \texttt{scriptfont}.

\texttt{\textbackslash boundary} Boundary of a subset \texttt{\textbackslash boundary A}: \partial A
\texttt{\textbackslash supp} Support of a function \texttt{\textbackslash supp f}: \texttt{supp f}
Uses \texttt{operatorfont}.

\texttt{\textbackslash dist} Distance \texttt{\textbackslash dist(p, A)}: \texttt{dist(p, A)}
Uses \texttt{operatorfont}.

\texttt{\textbackslash topology} Font for topology \texttt{\textbackslash topology\{M\}}: \texttt{\textbackslash M}
Uses \texttt{topologyfont}.

\texttt{\textbackslash filter} Font for filter \texttt{\textbackslash filter\{F\}}: \texttt{\mathcal{F}}
Uses \texttt{filterfont}.

\texttt{\textbackslash sheaf} Font for sheaves \texttt{\textbackslash sheaf\{F\}}: \texttt{\mathcal{F}}
Uses \texttt{sheaffont}.

\texttt{\textbackslash Sections} Discontinuous sections of a presheaf \texttt{\textbackslash Sections\{\textbackslash sheaf\{F\}\}}: \texttt{Sections(\mathcal{F})}
Uses \texttt{operatorfont}.

\texttt{\textbackslash HOM} Sheaf of morphisms between sheaves \texttt{\textbackslash HOM\{\textbackslash sheaf\{F\}, \textbackslash sheaf\{G\}\}}: \texttt{HOM(\mathcal{F}, \mathcal{G})}
Uses \texttt{sheaffont} and \texttt{mathit}.

\texttt{\textbackslash etale} Étale space of presheaf \texttt{\textbackslash etale\{\textbackslash sheaf\{F\}\}}: \texttt{\mathcal{F}}.

3.11.2 Categories from Topology

\texttt{\textbackslash topological} Category of topological spaces \texttt{\textbackslash topological}: \texttt{\textbackslash top}
Uses \texttt{categoryname}.

\texttt{\textbackslash Topological} Category of Hausdorff topological spaces \texttt{\textbackslash Topological}: \texttt{\textbackslash Top}
Uses \texttt{categoryname}.

\texttt{\textbackslash sheaves} Category of sheaves over a space \texttt{\textbackslash sheaves\{M\}}: \texttt{\textbackslash Sheaves(M)}
Uses \texttt{categoryname}.
\texttt{PreSheaves} Category of presheaves over a space \texttt{PreSheaves}(M): PreSheaves(M)

Uses \texttt{categoryname}.

\texttt{Etale} Category of étalé spaces over a space \texttt{Etale}(M): Etale(M)

Uses \texttt{categoryname}.

4 Known Bugs and Conflicts

There are several conflicts possible since \texttt{nchairx} loads a number of other packages, some with explicit options needed to obtain the aspired functionality. In this case, it can not be avoided that the packages is loaded via \texttt{nchairx}.

- The package \texttt{xkeyval} is loaded without options. This is necessary for many reasons like internal processing of ifs etc.
- The package \texttt{amsmath} and \texttt{amssymb} are loaded. This can sometimes yield unexpected conflicts with packages overwriting commands from these two packages.
- We define a smiley symbol from the \texttt{wasysym} font. This gives a conflict with the \texttt{wasysym} package.
- We load the \texttt{tensor} package and overwrite the \texttt{\textbackslash tensor} command of that package. The original macro is available under \texttt{\textbackslash original\textbackslash tensor} and as identical macro \texttt{\textbackslash decorate}.
- We load \texttt{ntheorem} with specified options. This is unavoidable to have the correct behaviour of our environments.
- The theorem lists from the \texttt{ntheorem} package seem to crash with the \texttt{babel} names we use for the actual environments. A workaround for this is e.g.

\begin{verbatim}
\makeatletter
\listtheorems{definitions} \makeatother
\end{verbatim}

to get the list of definitions.

5 Implementation

5.1 Processing the Options

Before including other packages we make sure that we can use key-value pairs as options using \texttt{xkeyval}

\begin{verbatim}
1 \RequirePackage{xkeyval}
\end{verbatim}

Before including other required packages we have to process the options that might alter the options given to these packages.

First we create ifs for later use.

\begin{verbatim}
2 \newif\if@loadmath \@loadmathtrue
\end{verbatim}

24
Define option for excluding math macros
3 \DeclareOptionX{chairx}{math}{noMath}{
4 \@loadmathfalse
5 }

Process options for the style file
6 \ProcessOptionsX{chairx}{math}

5.2 Required Packages

After processing the options we can now load the other required packages. The following packages are required for the correct usage of nchairx. We include them with some mandatory options.

We will need several things from amsmath and amssymb.
7 \RequirePackage{amsmath}
8 \RequirePackage{amssymb}

The suffix package allows to define -versions of macros.
9 \RequirePackage{suffix}

The mathtools package provides so many nice things to type-set math. Always a good idea to include this. In particular, we will need the \DeclarePairedDelimiter command a lot.
10 \RequirePackage{mathtools}

The ntheorem package is used to define math environments of various type. We need this package with particular options to make the proof environment work correctly. Note that the proof environment of ntheorem places the end-of-proof in a much better way than every other available option.
11 \RequirePackage[ntheorem]{amsmath,thmtools,hyperref}

The graphicx package is useful for many things. We need it for our logo support to include pdf-files.
12 \RequirePackage{graphicx}

The enumitem package is now used to generate the enumerated lists of items for the math environments. This allows various fine-tuning and additional functionality for referring to items in lists.
13 \RequirePackage{enumitem}

The tensor package is used to place symbols at all possible positions around one central symbol.
14 \RequirePackage{tensor}

Some additional fonts and symbols from stmaryrd: we only load the font and grab those symbols we actually need to keep things easy.
15 \DeclareSymbolFont{stmaryrd}{U}{stmaryrd}{m}{n}
16 \SetSymbolFont{stmaryrd}{bold}{U}{stmaryrd}{b}{n}

Last we need aliascnt to allow the usage of \autoref.
17 \RequirePackage{aliascnt}
5.3 The Handling of the Fonts

First we check of macros should be included:
\if@loadmath

We provide several font names for easier usage and customization. The fonts are used in our macro definitions and can be changed by according to the individual needs.

5.3.1 Default Values for some Math Fonts

\texttt{\mathbb}

Redefine \texttt{\mathbb} to use the nicer \texttt{\mathbbm}.
\begin{Verbatim}
\DeclareMathAlphabet{\mathbbm}{U}{bbm}{m}{n}
\SetMathAlphabet{\mathbbm}{bold}{U}{bbm}{bx}{n}
\renewcommand{\mathbbm}[1]{\mathbbm{#1}}
\end{Verbatim}

\texttt{\mathscr}

We load a script font and provide the command \texttt{\mathscr}.
\begin{Verbatim}
\DeclareMathAlphabet{\mathscr}{U}{rsfso}{m}{n}
\end{Verbatim}

\texttt{\mathcal}

We redefine the \texttt{\mathcal} command using the Euler font.
\begin{Verbatim}
\DeclareSymbolFont{EulerScript}{U}{eus}{m}{n}
\SetSymbolFont{EulerScript}{bold}{U}{eus}{b}{n}
\DeclareSymbolFontAlphabet{\mathcal}{EulerScript}
\end{Verbatim}

5.3.2 Setting Fonts for Various Math Groups

Definitions of fonts for the different groups.
\begin{Verbatim}
\define@key[chairx]{fonts}{algebrafont}{
\providecommand{\ch@irxalgebrafont}[1]{ }
\renewcommand{\ch@irxalgebrafont}{#1}
}
\define@key[chairx]{fonts}{basisfont}{
\providecommand{\ch@irxbasisfont}[1]{ }
\renewcommand{\ch@irxbasisfont}{#1}
}
\define@key[chairx]{fonts}{categoryfont}{
\providecommand{\ch@irxcategoryfont}[1]{ }
\renewcommand{\ch@irxcategoryfont}{#1}
}
\define@key[chairx]{fonts}{categorynamefont}{
\providecommand{\ch@irxcategorynamefont}[1]{ }
\renewcommand{\ch@irxcategorynamefont}{#1}
}
\define@key[chairx]{fonts}{fieldfont}{
\providecommand{\ch@irxfieldfont}[1]{ }
\renewcommand{\ch@irxfieldfont}{#1}
}
\define@key[chairx]{fonts}{gerstenhaberfont}{
\providecommand{\ch@irxgerstenhaberfont}[1]{ }
\renewcommand{\ch@irxgerstenhaberfont}{#1}
}
\define@key[chairx]{fonts}{groupfont}{
\providecommand{\ch@irxgroupfont}[1]{ }
\renewcommand{\ch@irxgroupfont}{#1}
}
\define@key[chairx]{fonts}{groupoidfont}{
\providecommand{\ch@irxgroupoidfont}[1]{ }
\renewcommand{\ch@irxgroupoidfont}{#1}
}
\define@key[chairx]{fonts}{hilbertfont}{
\providecommand{\ch@irxhilbertfont}[1]{ }
\renewcommand{\ch@irxhilbertfont}{#1}
}
\define@key[chairx]{fonts}{liealgfont}{
\providecommand{\ch@irxliealgfont}[1]{ }
\renewcommand{\ch@irxliealgfont}{#1}
}
\define@key[chairx]{fonts}{modulefont}{
\providecommand{\ch@irxmodulefont}[1]{ }
\renewcommand{\ch@irxmodulefont}{#1}
}
\define@key[chairx]{fonts}{prehilbfont}{
\providecommand{\ch@irxprehilbfont}[1]{ }
\renewcommand{\ch@irxprehilbfont}{#1}
}
\define@key[chairx]{fonts}{operatorfont}{
\providecommand{\ch@irxoperatorfont}[1]{ }
\renewcommand{\ch@irxoperatorfont}{#1}
}
\define@key[chairx]{fonts}{ringfont}{
\providecommand{\ch@irxringfont}[1]{ }
\renewcommand{\ch@irxringfont}{#1}
}
\define@key[chairx]{fonts}{scriptfont}{
\providecommand{\ch@irxscriptfont}[1]{ }
\renewcommand{\ch@irxscriptfont}{#1}
}
\define@key[chairx]{fonts}{sheaffont}{
\providecommand{\ch@irxsheaffont}[1]{ }
\renewcommand{\ch@irxsheaffont}{#1}
}
\define@key[chairx]{fonts}{spacesfont}{
\providecommand{\ch@irxspacesfont}[1]{ }
\renewcommand{\ch@irxspacesfont}{#1}
}
\define@key[chairx]{fonts}{topologyfont}{
\providecommand{\ch@irxtopologyfont}[1]{ }
\renewcommand{\ch@irxtopologyfont}{#1}
}
\end{Verbatim}
Here we need to change the default operatorfont in order to get the chairxoperatorfont also for \texttt{operatorname} and \texttt{DeclareMathOperator}. Note that redefining \texttt{operatorfont} with a symbol alphabet and not a symbol font forces us to use an additional bracket in all definitions using \texttt{operatorname} and \texttt{DeclareMathOperator}.
\renewcommand{\ch@irxringfont}{#1}
}\define@key[chairx]{fonts}{scriptfont}{
\providecommand{\ch@irxscriptfont}{#1}{ }
\renewcommand{\ch@irxscriptfont}{#1}{ }
}\define@key[chairx]{fonts}{sheaffont}{
\providecommand{\ch@irxsheaffont}{#1}{ }
\renewcommand{\ch@irxsheaffont}{#1}{ }
}\define@key[chairx]{fonts}{spacefont}{
\providecommand{\ch@irxspacefont}{#1}{ }
\renewcommand{\ch@irxspacefont}{#1}{ }
}\define@key[chairx]{fonts}{topologyfont}{
\providecommand{\ch@irxtopologyfont}{#1}{ }
\renewcommand{\ch@irxtopologyfont}{#1}{ }
}\chairxfonts Command for setting the fonts.
\newcommand{\chairxfonts}{[1]}{
\setkeys{chairx}{fonts}{#1}{ }
}\chairxfonts We use the following default settings for fonts.
\chairxfonts{
\algebrafont = \mathscr,
\basisfont = \mathit,
\categoryfont = \mathfrak,
\categorynamefont = \mathsf,
\fieldfont = \mathbb,
\filterfont = \mathfrak,
\functorfont = \mathsf,
\groupfont = \mathrm,
\groupoidfont = \mathfrak,
\gerstenhaberfont = \mathfrak,
\hilbertfont = \mathfrak,
\liealgfont = \mathfrak,
\modulefont = \mathscr,
\prehilbfont = \mathcal,
\operatorfont = \mathfrak,
\ringfont = \mathfrak,
\scriptfont = \mathsf,
\sheaffont = \mathscr,
\spacefont = \mathscr,
\topologyfont = \mathscr
}\chairxfonts code for grabbing a single glyph from some random font without investing a new
math alphabet: use only the wrapper macro as \ch@irxmathsymbol{mathtype}{fontname}{glyph}
with \texttt{mathtype} being the optional type of the symbol with default being \texttt{\mathord}, \texttt{\fontname} the name of the font where the symbol is to be found and \texttt{\glyph} the number of the symbol inside the specified font.

\begin{verbatim}
\newcommand{\ch@irxfont}[1]{\fontfamily{#1}\fontencoding{U}\fontseries{m}\fontshape{n}\selectfont}
\newcommand{\ch@irxsymbol}[2]{{\ch@irxfont{#1}\char#2}}
\newcommand{\ch@irxmathsymbol}[3][\mathord]{#1{\ch@irxm@thsymbol{#2}{#3}}}\newcommand{\ch@irxm@thsymbol}{\mathchoice\@ch@irxm@thsymbol{#1}{#2}{#3}}\def\@ch@irxm@thsymbol#1#2#3{\mbox{\fontsize{#3}{#3}\ch@irxsymbol{#1}{#2}}}
\end{verbatim}

}\fi

\section{Setting some Defaults}

Equations with section numbers.
\begin{verbatim}
\numberwithin{equation}{section}
\renewcommand{\theequation}{\thesection.\arabic{equation}}
\end{verbatim}

Page breaks allowed in long formulas by default.
\begin{verbatim}
\allowdisplaybreaks
\end{verbatim}

More space in arrays.
\begin{verbatim}
\renewcommand{\arraystretch}{1.2}
\end{verbatim}

Better spacing with \texttt{\left} and \texttt{\right} commands. Hack from TeXExchange
\url{https://tex.stackexchange.com/questions/2607/}
\begin{verbatim}
\let\originalleft\left
\let\originalright\right
\renewcommand{\left}{\mathopen{}\mathclose\bgroup\originalleft}
\renewcommand{\right}{\aftergroup\egroup\originalright}
\end{verbatim}

Empty left pages before new chapter. If not explicitly set to empty the headers might be non-empty with empty content pages. This typically looks rather weird. So the easiest way is to make the page completely blank.
\begin{verbatim}
\renewcommand{\cleardoublepage}{\clearpage\ifodd\c@page\else\vspace*{\fill}\thispagestyle{empty}\newpage\fi}
\end{verbatim}

\section{Environments}

First we define the names of the environments in English. Currently we support German and English if the \texttt{babel} package is loaded, insert more as you like.
\begin{verbatim}
\newcommand{\claimch@irxname}{Claim}
\newcommand{\conjecturech@irxname}{Conjecture}
\newcommand{\conventionch@irxname}{Convention}
\newcommand{\definitionch@irxname}{Definition}
\newcommand{\examplech@irxname}{Example}
\newcommand{\exercisech@irxname}{Exercise}
\newcommand{\hintch@irxname}{Hint}
\newcommand{\lemmach@irxname}{Lemma}
\newcommand{\mainthmch@irxname}{Main Theorem}
\newcommand{\notationch@irxname}{Notation}
\newcommand{\proofch@irxname}{Proof}
\newcommand{\propositionch@irxname}{Proposition}
\newcommand{\questionch@irxname}{Question}
\newcommand{\remarkch@irxname}{Remark}
\end{verbatim}
If the \texttt{babel} package is loaded with the option for English we fill them with the correct English words. Note that we also need the \texttt{strings} option to make this work. Otherwise we do nothing. Careful: no spaces allowed in the list!

Same thing in German.
Now we define the actual environments. We start with header in bold and body in italic.

\theoremheaderfont{\normalfont\bfseries} \theorembodyfont{\itshape}
Next we set the body font to roman.

And have some more environments, still numbered with the same counter.

The exercise environment has a separate counter.

We change now for the main theorem styling

The proof environments. We use the boxempty symbol from the AMSa font.
\def\theorem@checkbold{}

To make these new environments compatible with the \*autorefname macro of the hyperref-package, we need the following commands:

\providecommand{\claimautorefname}{\claimch@irxname}
\providecommand{\conjectureautorefname}{\conjecturech@irxname}
\providecommand{\conventionautorefname}{\conventionch@irxname}
\providecommand{\corollaryautorefname}{\corollarych@irxname}
\providecommand{\definitionautorefname}{\definitionch@irxname}
\providecommand{\lemmaautorefname}{\lemmach@irxname}
\providecommand{\propositionautorefname}{\propositionch@irxname}
\providecommand{\exampleautorefname}{\examplech@irxname}
\providecommand{\notationautorefname}{\notationch@irxname}
\providecommand{\questionautorefname}{\questionch@irxname}
\providecommand{\remarkautorefname}{\remarkch@irxname}
\providecommand{\exerciseautorefname}{\exercisech@irxname}
\providecommand{\thmautorefname}{\theoremch@irxname}
\providecommand{\maintheoremautorefname}{\maintheoremch@irxname}

To redefine \*autorefname commands which are predefined in hyperref, we need a little hack to allow that hyperref is loaded after nchairx we put these commands at the beginning of the document part.

\AtBeginDocument{

Now we fill the \*autorefname macros with the language specific names, in order to guarantee compatibility with babel. First in english
\ifpackagewith{babel}{english, strings}{% 
\StartBabel1Commands{english}{extras}
\SetString{\chapterautorefname}{\chapterch@irxname}
\SetString{\sectionautorefname}{\sectionch@irxname}
\SetString{\subsectionautorefname}{\subsectionch@irxname}
\SetString{\subsubsectionautorefname}{\subsubsectionch@irxname}
\EndBabel1Commands
\}%

then in german
\ifpackagewith{babel}{german, strings}{%
\StartBabel1Commands{german}{extras}
\}%

hint The hint environment, without numbers and very small.
\newenvironment{hint}{\par\footnotesize\medskip\noindent\hintch@irxname: }{\par\smallskip\normalsize}

In the theorem titles only the ordinary text in boldface, not the math formulas.

Nice hack from David Carlisle via tex.stackexchange

\def\theorem@checkbold{}

To make these new environments compatible with the \*autorefname macro of the hyperref-package, we need the following commands:

\providecommand{\claimautorefname}{\claimch@irxname}
\providecommand{\conjectureautorefname}{\conjecturech@irxname}
\providecommand{\conventionautorefname}{\conventionch@irxname}
\providecommand{\corollaryautorefname}{\corollarych@irxname}
\providecommand{\definitionautorefname}{\definitionch@irxname}
\providecommand{\lemmaautorefname}{\lemmach@irxname}
\providecommand{\propositionautorefname}{\propositionch@irxname}
\providecommand{\exampleautorefname}{\examplech@irxname}
\providecommand{\notationautorefname}{\notationch@irxname}
\providecommand{\questionautorefname}{\questionch@irxname}
\providecommand{\remarkautorefname}{\remarkch@irxname}
\providecommand{\exerciseautorefname}{\exercisech@irxname}
\providecommand{\thmautorefname}{\theoremch@irxname}
\providecommand{\maintheoremautorefname}{\maintheoremch@irxname}

To redefine \*autorefname commands which are predefined in hyperref, we need a little hack to allow that hyperref is loaded after nchairx we put these commands at the beginning of the document part.

\AtBeginDocument{

Now we fill the \*autorefname macros with the language specific names, in order to guarantee compatibility with babel. First in english
\ifpackagewith{babel}{english, strings}{% 
\StartBabel1Commands{english}{extras}
\SetString{\chapterautorefname}{\chapterch@irxname}
\SetString{\sectionautorefname}{\sectionch@irxname}
\SetString{\subsectionautorefname}{\subsectionch@irxname}
\SetString{\subsubsectionautorefname}{\subsubsectionch@irxname}
\EndBabel1Commands
\}%

then in german
\ifpackagewith{babel}{german, strings}{%
\StartBabel1Commands{german}{extras}
\}%

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Next, we define list environments for all the above types of math environments. They are built using the \texttt{enumitem} package and use a rather compact appearance. Each math environment has its own list, though all of them are equal at the moment.

\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label=\textit{\roman*.)}, #1]
\end{enumerate}

\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label=\textit{\roman*.)}, #1]
\end{enumerate}

\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label=\textit{\roman*.)}, #1]
\end{enumerate}

\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label=\textit{\roman*.)}, #1]
\end{enumerate}
\newenvironment{definitionlist}[1]
\{
\begin{enumerate}[\topsep = 0.2em, \partopsep = 0em, \itemsep = 0.2em, \parsep = 0.1em, \label=\textit{\roman*.)},
#1\
]\}
\end{enumerate}
\}

\newenvironment{lemmalist}[1]
\{
\begin{enumerate}[\topsep = 0.2em, \partopsep = 0em, \itemsep = 0.2em, \parsep = 0.1em, \label=\textit{\roman*.)},
#1\
]\}
\end{enumerate}
\}

\newenvironment{propositionlist}[1]
\{
\begin{enumerate}[\topsep = 0.2em, \partopsep = 0em, \itemsep = 0.2em, \parsep = 0.1em, \label=\textit{\roman*.)},
#1\
]\}
\end{enumerate}
\}

\newenvironment{theoremlist}[1]
\{
\begin{enumerate}[\topsep = 0.2em, \partopsep = 0em, \itemsep = 0.2em, \parsep = 0.1em, \label=\textit{\roman*.)},
#1\
]\}
\end{enumerate}
\}
\begin{prooflist}
\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label={\textit{\roman*.)}}, #1]
\end{enumerate}
\end{prooflist}

\begin{examplelist}
\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label={\textit{\roman*.)}}, #1]
\end{enumerate}
\end{examplelist}

\begin{notationlist}
\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label={\textit{\roman*.)}}, #1]
\end{enumerate}
\end{notationlist}

\begin{questionlist}
\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label={\textit{\roman*.)}}, #1]
\end{enumerate}
\end{questionlist}

\begin{remarklist}
\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label={\textit{\roman*.)}}, #1]
\end{enumerate}
\end{remarklist}

Also for the following environments we have lists:

\begin{notationlist}
\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label={\textit{\roman*.)}}, #1]
\end{enumerate}
\end{notationlist}

\begin{questionlist}
\begin{enumerate}[topsep = 0.2em, partopsep = 0em, itemsep = 0.2em, parsep = 0.1em, label={\textit{\roman*.)}}, #1]
\end{enumerate}
\end{questionlist}
For the exercises we also need a separate list.

And the main theorem might also consist of several parts which we want to number.

We also provide compact versions of the lists in general (similar to the \texttt{paralist} package)
5.6 Logo Support

The header logo with textwidth

\includegraphics[width=\textwidth]{nchairxheader.pdf}

The logo with variable width

\includegraphics[width=#1]{nchairxlogo.pdf}

5.7 The Math Macros

Include the math macros in alphabetical order of the file names.
First we check of macros should be included:
\if@loadmath
5.7.1 The New Delimiters

Bigger than \texttt{\textbackslash Bigg} commands for explicit re-sizing brackets and things needs left/right version to work with \texttt{\textbackslash DeclarePairedDelimiters}. Hack from http://tex.stackexchange.com/questions/262061

\begin{verbatim}
\newcommand{\vast}{\bBigg@{4}}
\newcommand{\Vast}{\bBigg@{5}}
\newcommand{\vastl}{\mathopen\vast}
\newcommand{\vastm}{\mathrel\vast}
\newcommand{\vastr}{\mathclose\vast}
\newcommand{\Vastl}{\mathopen\Vast}
\newcommand{\Vastm}{\mathrel\Vast}
\newcommand{\Vastr}{\mathclose\Vast}
\end{verbatim}

First we check of macros should be included:

\begin{verbatim}
\if@loadmath
\end{verbatim}

5.7.2 Decoration

\texttt{\textbackslash decorate} We use the tensor package of Philip G. Ratcliffe 2004/12/20 v2.1 tensor indices package (PGR) but overwrite the \texttt{\textbackslash tensor} command as this collides with our own version. Instead we provide the \texttt{\textbackslash decorate} macro which is identical to \texttt{\textbackslash tensor} of the tensor package.

\begin{verbatim}
\DeclareRobustCommand{\decorate}{\originaltensor}
\end{verbatim}

\texttt{\textbackslash deco} This is a simplified version of \texttt{\textbackslash decorate} allowing only five positions to be filled.

\begin{verbatim}
\newcommand{\deco}[5]{\decorate[^{\texttt{#1}}_{\texttt{#2}}]{\texttt{#3}}[^{\texttt{#4}}_{\texttt{#5}}]}
\end{verbatim}

\texttt{\textbackslash script} Macro to access the \texttt{scriptfont}.

\begin{verbatim}
\newcommand{\script}[1]{\texttt{\textbackslash ch@irxscriptfont\texttt{#1}}}
\end{verbatim}

First we check of macros should be included:

\begin{verbatim}
\if@loadmath
\end{verbatim}

5.7.3 General Math Commands

\texttt{\textbackslash I} \begin{verbatim}
\newcommand{\I}{\texttt{\textbackslash mathrm{\texttt{i}}}}
\end{verbatim}

\texttt{\textbackslash E} \begin{verbatim}
\newcommand{\E}{\texttt{\textbackslash mathrm{\texttt{e}}}}
\end{verbatim}

\texttt{\textbackslash D} \begin{verbatim}
\newcommand{\D}{\texttt{\textbackslash mathop/\textbackslash \texttt{mathrm{d}}}}
\end{verbatim}
\newcommand{\cc}{\overline{\#1}}

\newcommand{\sign}{\operatorname{\text{sign}}}

\newcommand{\RE}{\operatorname{\text{Re}}}

\newcommand{\IM}{\operatorname{\text{Im}}}

\newcommand{\Unit}{\mathbb{1}}

\newcommand{\const}{\operatorname{\mathit{const}}}

\newcommand{\canonical}{\mathcal{c_an}}

\newcommand{\pt}{\operatorfont{pt}}

\newcommand{\at}[2]{#1\vert_{#2}}

\newcommand{\Map}{\operatorfont{Map}}

\newcommand{\Bij}{\operatorfont{Bij}}

\newcommand{\argument}{\cdot}

\newcommand{\domain}{\operatorfont{dom}}

\newcommand{\range}{\operatorfont{range}}

\newcommand{\id}{\operatorfont{id}}

\section{5.7.4 Restrictions}

\section{5.7.5 Maps and Related Stuff}
\newcommand{\pr}{\operatorname{pr}}
\newcommand{\inv}{\operatorname{inv}}
\newcommand{\ev}{\operatorname{ev}}
\newcommand{\image}{\operatorname{im}}
\newcommand{\graph}{\operatorname{graph}}
\newcommand{\coimage}{\operatorname{coim}}
\newcommand{\coker}{\operatorname{coker}}
\newcommand{\operator}[1]{\operatorname{#1}}
\newcommand{\later}{\succcurlyeq}
\newcommand{\earlier}{\preccurlyeq}

5.7.6 Relations
\later \newcommand{\later}{\mathrel{\succcurlyeq}}
\earlier \newcommand{\earlier}{\mathrel{\preccurlyeq}}

5.7.7 Sums and Products
\bigop \text{To define sum-like operators that are scaled up in displaystyle we define the following command taken from tex.stackexchange.com/questions/23432/how-to-create-my-own-math-operator-with-limits}
\DeclareRobustCommand{\bigop}[2][1]{%
  \mathop{\vphantom{\sum}\mathpalette{\bigop@}{\textstyle#1}}\slimits@
}\newcommand{\bigop@}[2]{\bigop@@#1#2}
\newcommand{\bigop@@}[3]{%
  \vcenter{\sbox\z@{\textstyle\sum}\hbox{\resizebox{\ifx#1\textstyle#2\fi\dimexpr\ht\z@+\dp\z@}{!}{$\m@th#3$}}}%
}
\newcommand{\bigop}[2][2]{\bigop@@{\textstyle#1}#2}
\newcommand{\bigop}[3][3]{%}
\vcenter{%
  \sbox\z@{$\textstyle\sum$}\hbox{\resizebox{#1\ht\z@}{!}{$\textstyle\sum$}}%
}\resizebox{#1\ht\z@}{!}{$\textstyle\sum$}
The command `\DOTSB` is used for correct behaviour of `\dots` before or after the command.

572 `\newcommand{\bigplus}{\DOTSB\bigoplus}`

`\bigtimes`

573 `\newcommand{\bigtimes}{\DOTSB\bigotimes}`

`\biprod`

574 `\newcommand{\biprod}{\DOTSB\bigoplus{\mathrel{\prod\hspace{-0.4cm}\coprod}}}}`

5.7.8 Labels

Smiley from `wasysym`

575 `\newcommand{\smiley}{\ch@irxmathsymbol\mathord{wasy}{44}}`

Frownie from `wasysym`

576 `\newcommand{\frownie}{\ch@irxmathsymbol\mathord{wasy}{47}}`

`\heart`

577 `\newcommand{\heart}{\heartsuit}`

578 `\fi`

First we check of macros should be included:

579 `\if@loadmath`

5.7.9 Fonts for Rings and Things

`\field`

580 `\newcommand{\field}[1]{\ch@irxfieldfont{#1}}`

`\ring`

581 `\newcommand{\ring}[1]{\ch@irxringfont{#1}}`

`\group`

582 `\newcommand{\group}[1]{\ch@irxgroupfont{#1}}`

`\algebra`

583 `\newcommand{\algebra}[1]{\ch@irxalgebrafont{#1}}`

`\module`

584 `\newcommand{\module}[1]{\ch@irxmodulefont{#1}}`

`\liealg`

585 `\newcommand{\liealg}[1]{\ch@irxliealgfont{#1}}`
5.7.10 Some Symbols needed in Algebra

\Pol
\lmult
\rmult
\Lmult
\Rmult
\Center Needs \texttt{mathrsfs} package.
\ad
\Ad
\Conj
\acts
\racts
\Char
\modulo
5.7.11 Categories from Algebra
\Reps
622 \newcommand{\Reps}{\categoryname{Rep}}
623 \WithSuffix\newcommand{\Reps*}{\decorate[^*]{\textsf{-}\Reps}{}}

\PoissonAlg
624 \newcommand{\PoissonAlg}{\categoryname{PoissonAlg}}
625 \WithSuffix\newcommand{\PoissonAlg*}{\decorate[^*]{\textsf{-}\PoissonAlg}{}}

\modules
626 \newcommand{\modules}{\categoryname{mod}}
627 \WithSuffix\newcommand{\modules*}{\decorate[^*]{\textsf{-}\modules}{} }

\Leftmodules
628 \newcommand{\Leftmodules}[1][\#1]{\textsf{-}\categoryname{mod}}

\Rightmodules
629 \newcommand{\Rightmodules}[2][\#1]{\categoryname{mod}_{#1}\textsf{-}{#2}}

\Modules
630 \newcommand{\Modules}{\categoryname{Mod}}
631 \WithSuffix\newcommand{\Modules*}{\decorate[^*]{\textsf{-}\Modules}{} }

\LeftModules
632 \newcommand{\LeftModules}[1][\#1]{\textsf{-}\categoryname{Mod}}

\RightModules
633 \newcommand{\RightModules}[2][\#1]{\categoryname{Mod}_{#1}\textsf{-}{#2}}

\Bimodules
634 \newcommand{\Bimodules}{\categoryname{Bimod}}
635 \WithSuffix\newcommand{\Bimodules*}{\decorate[^*]{\textsf{-}\Bimodules}{} }

\Rings
636 \newcommand{\Rings}{\categoryname{Ring}}

\Groups
637 \newcommand{\Groups}{\categoryname{Group}}

\Ab
638 \newcommand{\Ab}{\categoryname{Ab}}

\Lattices
639 \newcommand{\Lattices}{\categoryname{Lattice}}

\Sets
640 \newcommand{\Sets}{\categoryname{Set}}
% Vect
641 \newcommand{\Vect}{\categoryname{Vect}}

% LieAlgs
642 \newcommand{\LieAlgs}{\categoryname{LieAlg}}

% Posets
643 \newcommand{\Posets}{\categoryname{Poset}}

% Directed
644 \newcommand{\Directed}{\categoryname{Directed}}

% GSets
645 \newcommand{\GSets}[1][\{G\}]{\#1\text{-}\Sets}

% Groupoids
646 \newcommand{\Groupoids}{\categoryname{Groupoid}}

\fi

First we check of macros should be included:
648 \if@loadmath

5.7.12 General Analysis

% vol
649 \newcommand{\vol}{\ch@irxoperatorfont{vol}}

% complete
650 \newcommand{\complete}[1]{\widehat{#1}}

% Ball
651 \newcommand{\Ball}{\ch@irxoperatorfont{B}}

% abs
652 \DeclarePairedDelimiter{abs}{\lvert}{\rvert}

% norm
653 \DeclarePairedDelimiter{norm}{\lVert}{\rVert}

% supnorm
654 \newcommand{\@supnormstar}[1]{\norm*{#1}_\infty}
655 \newcommand{\@supnormnostar}[2]{\norm{#1}{#2}_\infty}
656 \newcommand{\supnorm}{\@ifstar\@supnormstar\@supnormnostar}

% expands
657 \newcommand{\expands}[1][2.5]{\mathrel{\scalebox{#1}[1.1]{\$\sim$}}}
5.7.13 Pseudodifferential Operators

\std \newcommand{\std}{\scriptscriptstyle{\ch@irxscriptfont{std}}} 
\Weyl \newcommand{\Weyl}{\scriptscriptstyle{\ch@irxscriptfont{Weyl}}} 
\Op \newcommand{\Op}{\operatorname{Op}} 
\Opstd \newcommand{\Opstd}{\operatorname{Op}_\std} 
\OpWeyl \newcommand{\OpWeyl}{\operatorname{Op}_\Weyl} 

5.7.14 Function Spaces

\spacename \newcommand{\spacename}[1]{\ch@irxspacefont{#1}} 
\Bounded \newcommand{\Bounded}{\ch@irxspacefont{B}} 
\Continuous \newcommand{\Continuous}{\ch@irxspacefont{C}} 
\Contbound \newcommand{\Contbound}{\Continuous_{\mathrm{b}}} 
\Fun \newcommand{\Fun}[1][k]{\ch@irxspacefont{C}^{#1}} 
\Cinfty \newcommand{\Cinfty}{\Fun[\infty]} 
\Comega \newcommand{\Comega}{\Fun[\omega]} 
\Holomorphic \newcommand{\Holomorphic}{\ch@irxspacefont{O}} 
\AntiHolomorphic \newcommand{\AntiHolomorphic}{\cc{\Holomorphic}} 
\Schwartz \newcommand{\Schwartz}{\ch@irxspacefont{S}} 
\Riemann \newcommand{\Riemann}{\ch@irxspacefont{R}}
5.7.15 Locally Convex Spaces

\singsupp
674 \newcommand{\singsupp}{\operatorname{sing\,supp}}

\seminorm
675 \newcommand{\seminorm}[1]{\mathrm{#1}}

\ord
676 \newcommand{\ord}{\operatorname{ord}}

\conv
677 \newcommand{\conv}{\operatorname{conv}}

\extreme
678 \newcommand{\extreme}{\operatorname{extreme}}

5.7.16 Hilbert Spaces

\hilbert
679 \newcommand{\hilbert}[1]{\ch@irxhilbertfont{#1}}

\prehilb
680 \newcommand{\prehilb}[1]{\ch@irxprehilbfont{#1}}

\Adjointable
681 \newcommand{\Adjointable}[1][]{{\mathfrak{B}_{\scriptscriptstyle{#1}}}}

\Finite
682 \newcommand{\Finite}[1][]{{\mathfrak{F}_{\scriptscriptstyle{#1}}}}

\Compact
683 \newcommand{\Compact}[1][]{{\mathfrak{K}_{\scriptscriptstyle{#1}}}}

\opdomain
684 \newcommand{\opdomain}{\ch@irxhilbertfont{D}}

\spec
685 \newcommand{\spec}{\operatorname{\ch@irxoperatorfont{spec}}}

\closure
686 \newcommand{\closure}[1][]{{\overline{#1}}}

\res
687 \newcommand{\res}{\operatorname{\ch@irxoperatorfont{res}}}

\Res
688 \newcommand{\Res}{\operatorname{\ch@irxoperatorfont{Res}}}

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5.7.17 Dirac's bra and ket
\[ \bra \ket \]
\[ \braket \ketbra \]
\[ \DeclarePairedDelimiter{\ketbr@}{\vert}{\vert} \]
\[ \DeclarePairedDelimiter{\ket}{\langle}{\rangle} \]
\[ \DeclarePairedDelimiter{\bra}{\langle}{\vert} \]
\[ \newcommand{\braket}{\SP[#1]{#2 #1\vert #3}} \]
\[ \newcommand{\ketbra}{\ketbr@[#1]{#2 #1\rangle #1\langle #3}} \]

5.7.18 Operator Algebras
\[ \Spec \]
\[ \Rad \]
\[ \ind \]
\[ \Measurable \]
\[ \Meas \]
\[ \BoundMeas \]
\[ \Lp \]
\[ \Lone \]
\[ \Ltwo \]

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\Linfy \newcommand{\Linfty}{\Lp[\infty]}
\Intp \newcommand{\Intp[1][\{p\}]{\ch@irxsfont{L}^{#1}}
\Intone \newcommand{\Intone}{\Intp[1]}
\Inttwo \newcommand{\Inttwo}{\Intp[2]}
\Intinfty \newcommand{\Intinfty}{\Intp[\infty]}
\essrange \newcommand{\essrange}{\operatorname{\ch@irxoperatorfont{ess\,range}}}
\esssup \newcommand*{\esssup}{\operatorname*{\ch@irxoperatorfont{ess\,sup}}}
\esssupnormstar \newcommand*{\@esssupnormstar[1]{\norm*{#1}_{\esssup}}}
\esssupnormnostar \newcommand*{\@esssupnormnostar[2]{\norm{#1}_{\esssup}}}
\esssupnorm \newcommand*{\esssupnorm}{\@ifstar\@esssupnormstar\@esssupnormnostar}
\ac \newcommand{\ac}{\ch@irxscriptfont{ac}}
\sing \newcommand{\sing}{\ch@irxscriptfont{sing}}

5.7.20 Limits
\indlim \newcommand{\indlim}{\operatorname*{\{ind\,lim\}}}
\projlim \renewcommand{\projlim}{\operatorname*{\{proj\,lim\}}}
\fi
First we check of macros should be included:
\if@loadmath
5.7.21 General Category Theory

General stuff for categories.

\category \newcommand{\category}[1]{\ch@irxcategoryfont{#1}}
\categoryname \newcommand{\categoryname}[1]{\ch@irxcategorynamefont{#1}}
\functor \newcommand{\functor}[1]{\ch@irxfunctorfont{#1}}
\groupoid \newcommand{\groupoid}[1]{\ch@irxgroupoidfont{#1}}
\source \newcommand{\source}{\ch@irxoperatorfont{source}}
\target \newcommand{\target}{\ch@irxoperatorfont{target}}
\unit \newcommand{\unit}{\ch@irxoperatorfont{unit}}
\opp \newcommand{\opp}{\ch@irxscriptfont{opp}}
\asso \newcommand{\asso}{\ch@irxoperatorfont{asso}}
\Hom \newcommand{\Hom}{\operatorname{\ch@irxoperatorfont{Hom}}}
\End \newcommand{\End}{\operatorname{\ch@irxoperatorfont{End}}}
\Aut \newcommand{\Aut}{\operatorname{\ch@irxoperatorfont{Aut}}}
\WithSuffix\newcommand{\Aut*}{\decorate[^*]{\operatorname{-\Aut}}}{}
\Iso \newcommand{\Iso}{\operatorname{\ch@irxoperatorfont{Iso}}}
\WithSuffix\newcommand{\Iso*}{\decorate[^*]{\operatorname{-\Iso}}}{}
\Obj \newcommand{\Obj}{\operatorname{\ch@irxoperatorfont{Obj}}}
\Morph \newcommand{\Morph}{\operatorname{\ch@irxoperatorfont{Morph}}}

51
5.7.22 Colimits

\colim
739 \newcommand{\colim}{\operatorname*{\text{colim}}}
740 \fi
First we check of macros should be included:
741 \if@loadmath

5.7.23 General Differential Geometry

\Lie
742 \newcommand{\Lie}{\mathscr{L}}
A generic bracket as paired delimiter, used in several other macros
\ch@irxbracket
743 \DeclarePairedDelimiter{\ch@irxbracket}{[}{]}
A generic double bracket as paired delimiter, used in several other macros
\ch@irxbracket
744 \DeclareMathDelimiter{\ch@irxllbbracket}{\mathopen}{\scriptstyle}{4A}{\scriptstyle}{71}
745 \DeclareMathDelimiter{\ch@irxrrbbracket}{\mathclose}{\scriptstyle}{4B}{\scriptstyle}{79}
746 \DeclarePairedDelimiter{\ch@irxbbracket}{\ch@irxllbbracket}{\ch@irxrrbbracket}
\Schouten
747 \newcommand{\@schoutenstar}[1][1]{\ch@irxbbracket*{#1}_{\scriptscriptstyle\ch@irxscriptfont{S}}}
748 \newcommand{\@schoutennostar}[2][2]{\ch@irxbbracket{#1}{#2}_{\scriptscriptstyle\ch@irxscriptfont{S}}}
749 \newcommand{\Schouten}{\if@star\@schoutenstar\@schoutennostar}
\Forms
750 \newcommand{\Forms}{\Omega}
\ZdR
751 \newcommand{\ZdR}{\ch@irxoperatorfont{Z}_{\scriptscriptstyle\mathrm{dR}}}
\BdR
752 \newcommand{\BdR}{\ch@irxoperatorfont{B}_{\scriptscriptstyle\mathfrak{dR}}}
\HdR
753 \newcommand{\HdR}{\ch@irxoperatorfont{H}_{\scriptscriptstyle\mathfrak{dR}}}
\Diffeo
754 \newcommand{\Diffeo}{\operatorname{\ch@irxoperatorfont{Diffeo}}}
\Diffop
755 \newcommand{\Diffop}{\operatorname{\ch@irxoperatorfont{DiffOp}}}

52
5.7.24 Lie Groups and Principal Fiber Bundles
\fund    774 \newcommand{\fund}{\textup{fund}}
\Universal    775 \newcommand{\Universal}{\textup{U}}
\BCH    776 \newcommand{\BCH}{\textup{BCH}}
\LieGroups    777 \newcommand{\LieGroups}{\textup{LieGroup}}
\Principal    778 \newcommand{\Principal}{\textup{Principal}}
\GPrincipal    779 \newcommand{\GPrincipal}{\textup{Principal}}
\Fiber    780 \newcommand{\Fiber}{\textup{Fiber}}
\FFiber    781 \newcommand{\FFiber}{\textup{Fiber}}
\Pin    782 \newcommand{\Pin}{\textup{Pin}}
\Spin    783 \newcommand{\Spin}{\textup{Spin}}

5.7.25  (Pseudo) Riemannian Geometry
\nablaLC    784 \newcommand{\nablaLC}{\textup{LC}}
\Laplace    785 \newcommand{\Laplace}{\textup{\Delta}}
\dAlembert    786 \DeclareMathSymbol{\dAlembert}{\mathord}{\textup{\AMSa}}{"03}
\feynman    787 \newcommand{\feynman}{\textup{D}}
\Dirac    788 \newcommand{\Dirac}{\textup{D}}

54
5.7.26 Complex Geometry
5.7.28 Symplectic and Poisson Geometry

\Sympl
820 \newcommand{\Sympl}{\operatorname{\ch@irxgroupfont{Sympl}}}\
\Jacobiator
821 \newcommand{\Jacobiator}[1][\pi]{\operatorname{\ch@irxoperatorfont{Jac}}}_{#1}
\red
822 \newcommand{\red}{\ch@irxscriptfont{red}}\
\Hess
823 \newcommand{\Hess}{\operatorname{\ch@irxoperatorfont{Hess}}}\
\KKS
824 \newcommand{\KKS}[\scriptscriptstyle\ch@irxscriptfont{KKS}]{\scriptscriptstyle\ch@irxscriptfont{KKS}}\
\Courant
825 \newcommand{\Courant}@courantstar[1]{\ch@irxbbracket*{#1}_{\scriptscriptstyle\ch@irxscriptfont{C}}}\
826 \newcommand{\Courant@courantnostar}[2]{\ch@irxbbracket[#1]{#2}_{\scriptscriptstyle\ch@irxscriptfont{C}}}\
827 \newcommand{\Courant}{\@ifstar\Courant@courantstar}\Courant@courantnostar\
\Dorfman
828 \newcommand{\Dorfman@dorfsanstarr}[1]{\ch@irxbbracket*{#1}_{\scriptscriptstyle\ch@irxscriptfont{D}}}\
829 \newcommand{\Dorfman@dorfnostarr}[2]{\ch@irxbbracket[#1]{#2}_{\scriptscriptstyle\ch@irxscriptfont{D}}}\
830 \newcommand{\Dorfman}{\@ifstar\Dorfman@dorfsanstarr}\Dorfman@dorfnostarr\
\Dir
831 \newcommand{\Dir}{\operatorname{\ch@irxoperatorfont{Dir}}}\
\Forward
832 \newcommand{\Forward}{\mathcal{F}}\
\Backward
833 \newcommand{\Backward}{\mathcal{B}}\
\Tangent
834 \newcommand{\Tangent}{\mathbb{T}}\
\MWreduction
835 \newcommand{\MWreduction}{\big/\!\!\!\big/}\
\Mon
836 \newcommand{\Mon}{\ch@irxoperatorfont{Mon}}\
\Hol
837 \newcommand{\Hol}{\ch@irxoperatorfont{Hol}}\
838 \fi\
First we check of macros should be included:
839 \if@loadmath
5.7.29 General Linear Algebra

\newcommand{\operatorname{\ch@irxoperatorfont{tr}}}
\newcommand{\operatorname{\ch@irxoperatorfont{rank}}}
\newcommand{\operatorname{\ch@irxoperatorfont{codim}}}
\newcommand{\operatorname{\ch@irxoperatorfont{diag}}}
\newcommand{{\scriptscriptstyle{T}}}
\newcommand{\ch@irxoperatorfont{M}}
\newcommand{\ch@irxoperatorfont{SymMat}}
\newcommand{\ch@irxscriptfont{ann}}
\newcommand{\operatorname{\ch@irxoperatorfont{span}_{#1}}}
\newcommand{\ch@irxbasisfont{#1}}
\newcommand{\mathbin{\otimes_{\scriptscriptstyle{#1}}}}
\newcommand{\ch@irxoperatorfont{T}}
\newcommand{\Lambda}
\newcommand{\ch@irxoperatorfont{S}}
\newcommand{\operatorname{\ch@irxoperatorfont{Sym}}}
\newcommand{\ch@irxoperatorfont{Sym}}

5.7.30 Tensors

\renewcommand{\mathbin{\otimes_{\scriptscriptstyle{#1}}}}
\newcommand{\ch@irxoperatorfont{T}}
\newcommand{\ch@irxoperatorfont{Sym}}
5.7.31 Inner Products

\SP
\DeclarePairedDelimiter{\SP} {\langle}{\rangle}

\littlepara
\newcommand{\littlepara}{\scriptscriptstyle\parallel}

\IP
\newcommand{\IP}[6]{\decorate[^{#2}_{#3}]{\SP[#1]{#4}}^{#5}_{#6}}
\fi

First we check of macros should be included:
\if@loadmath

5.7.32 General Statistics

\EX
\newcommand{\EX}{\operatorname{\ch@irxoperatorfont{E}}}

\Var
\newcommand{\Var}{\operatorname{\ch@irxoperatorfont{Var}}}

\Cov
\newcommand{\Cov}{\operatorname{\ch@irxoperatorfont{Cov}}}

59
First we check of macros should be included:
\if@loadmath

5.7.33 General Topology

\cl
\newcommand{\cl}{\ch@irxscriptfont{cl}}
\scl
\newcommand{\scl}{\ch@irxscriptfont{scl}}
\interior
\newcommand{\interior}{\ch@irxoperatorfont{\circ}}
\boundary
\newcommand{\boundary}{\ch@irxoperatorfont{\partial}}
\supp
\newcommand{\supp}{\ch@irxoperatorfont{\operatorname{supp}}}
\dist
\newcommand{\dist}{\ch@irxoperatorfont{\operatorname{dist}}}
\topology
\newcommand{\topology}[1]{\ch@irxtopologyfont{#1}}
\filter
\newcommand{\filter}[1]{\ch@irxfilterfont{#1}}
\sheaf
\newcommand{\sheaf}[1]{\ch@irxsheaffont{#1}}
\Sections
\newcommand{\Sections}{\ch@irxoperatorfont{Sections}}
\HOM
\newcommand{\HOM}[1]{\ch@irxsheaffont{H}\mathit{om}}
\etale
\DeclarePairedDelimiter{\etale}{\lvert}{\rvert}
5.7.34  Categories from Topology

\texttt{\textbackslash topological}
885 \texttt{\newcommand{\textbackslash topological}{\categoryname{top}}} \\
\texttt{\textbackslash Topological}
886 \texttt{\newcommand{\textbackslash Topological}{\categoryname{Top}}} \\
\texttt{\textbackslash Sheaves}
887 \texttt{\newcommand{\textbackslash Sheaves}{\categoryname{Sheaves}}} \\
\texttt{\textbackslash PreSheaves}
888 \texttt{\newcommand{\textbackslash PreSheaves}{\categoryname{PreSheaves}}} \\
\texttt{\textbackslash Etale}
889 \texttt{\newcommand{\textbackslash Etale}{\categoryname{Etale}}} \\
890 \texttt{\fi}