The ChairX Math package

ChairX
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July 30, 2021

Abstract

This is a part of the new ChairX package providing the famous ChairX macros for mathematics.

Contents

1 Introduction

This package defines the new package `chairxmath`. It can be used as a standalone version of the math macros from `nchairx` if the other settings and defaults of `nchairx` are not needed or wanted.

2 Usage

2.1 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:

- `algebrafont` for generic algebras.
  Can be accessed via `\algebra`.
  Default font: `\mathscr`
- `basisfont` for bases of vector spaces.
  Can be accessed via `\basis`.
  Default font: `\mathit`
- `categoryfont` for generic categories.
  Can be accessed via `\category`.
  Default font: `\mathfrak`
- `categorynamefont` for predefined categories.
  Can be accessed via `\categoryname`.
  Default font: `\mathsf`
- `fieldfont` for generic fields.
  Can be accessed via `\field`.
  Default font: `\mathbb`
- `filterfont` for generic filters.
  Can be accessed via `\filter`.
  Default font: `\mathfrak`
- `functorfont` for generic functors.
  Can be accessed via `\functor`.
  Default font: `\mathsf`
- `gerstenhaberfont` for generic Gerstenhaber algebras.
  Can be accessed via `\gerstenhaber`.
  Default font: `\mathfrak`
- `groupfont` for the matrix groups.
  Can be accessed via `\group`.
  Default font: `\mathrm`

- `groupoidfont` for generic groupoids.
  Can be accessed via `\groupoid`.
  Default font: `\mathfrak`
- `hilbertfont` for Hilbert spaces.
  Can be accessed via `\hilbert`.
  Default font: `\mathfrak`
- `liealgfont` for generic Lie algebras.
  Can be accessed via `\liealg`.
  Default font: `\mathfrak`
- `modulefont` for generic modules.
  Can be accessed via `\module`.
  Default font: `\mathscr`
- `prehilbfont` for pre-Hilbert space.
  Can be accessed via `\prehilb`.
  Default font: `\mathcal`
- `operatorfont` for most common operators.
  Can be accessed via `\operator`.
  Default font: `\mathrm`
- `ringfont` for generic rings.
  Can be accessed via `\ring`.
  Default font: `\mathsf`
- `scriptfont` for subscripts.
  Can be accessed via `\script`.
  Default font: `\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}
```

2.2 New Delimiters

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`, ..., `\Bigg`, `\vast`, or `\Vast` like

`\Schouten[\vast]{X, Y}`: $\left[\!\!\left[X, Y \right]\!\!\right]_{\mathrm{S}}$

or you can use the *-version which produces automatic sizes via `\left` and `\right`.

`\abs*{\lim\limits_{n\to\infty} b_n}` 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:

good `\abs{\det(A)}`: $|\det(A)|$ bad `|\det(A)|`: $|\det(A)|$

`\vast` `\Vast` `\vastl` `\vastm` `\vastr` `\Vastl` `\Vastm` `\Vastr`

In many formulas one needs large delimiters typically ranging from `\big` to `\Bigg`. However, in very large formula constructions even that is not enough. To have a systematic enlargement the following delimiters sizes are introduced: `\vast` and `\Vast` together with the corresponding helper macros `\vastl`, `\vastr`, `\vastm`, `\Vastl`, `\Vastr`, and `\Vastm` needed to define pairs of delimiters. They allow to produce large (pairs of) delimiters, always provided that the corresponding font has the symbols in the correct size.
The following commands allow for an option size argument:

- Absolute value `\abs`
- Generic norm `\norm`
- Supremum norm `\supnorm`
- Essential supremum norm `\essupnorm`
- Dirac ket `\ket`
- Dirac bra `\bra`
- Dirac ketbra `\ketbra`
- Dirac braket `\braket`
- Schouten bracket `\Schouten`
- Nijenhuis-Richardson bracket `\NRbracket`

- Frölicher-Nijenhuis bracket `\FNbracket`
- Courant bracket `\Courant`
- Dorfman bracket `\Dorfman`
- Generic scalar product `\SP`
- Generic inner product with decorations `\IP`
- Restriction of a map `\at`
- Étalé space of a presheaf `\etale`

2.3 General Mathematics Macros

2.3.1 General Math Commands

`\I` Imaginary unit `\I`: i

`\E` Euler number `\E`: e

`\D` Differential `\D x`: $\mathrm{d}x$

`\cc` Complex conjugation `z \mapsto \cc{z}`: $z \mapsto \overline{z}$

`\sign` Signum `\sign \sigma`: $\operatorname{sign}\sigma$
Uses `operatorfont`.

`\RE` Real part (the standard symbols are sooo ugly) `\RE(z)`: $\operatorname{Re}(z)$
Uses `operatorfont`.

`\IM` Imaginary part `\IM(z)`: $\operatorname{Im}(z)$
Uses `operatorfont`.

`\Unit` Unit element `\Unit`: $\mathbb{1}$

`\const` Generic constant `\const`: *const*
Uses `mathit` as font.

`\canonical` Subscript for canonical `\omega_\canonical`: ω_{can}
Uses `scriptfont`.

`\pt` A single point `\{\pt\}`: {pt}
Uses `operatorfont`

2.3.2 Restrictions

`\at` Restriction of a map to a subset `f\at{U}`: $f\big|_U$ or with optional size `f\at[\Big]{U}`: $f\Big|_U$.
Default size is `\big`.

2.3.3 Maps and Related Stuff

`\Map` Space of maps `\Map(X, Y)`: $\operatorname{Map}(X,Y)$
Uses `operatorfont`.

`\Bij` Space of bijections `\Bij(X, Y)`: $\operatorname{Bij}(X,Y)$
Uses `operatorfont`.

`\argument` Generic argument of a map `f(\argument)`: $f(\cdot)$

`\domain` Domain of a map `\domain(\phi)`: $\mathrm{dom}(\phi)$
Uses `operatorfont`.

`\range` Range of a map `\range(\phi)`: $\mathrm{range}(\phi)$
Uses `operatorfont`.

`\id` Identity map `\id`: id
Uses `operatorfont`.

`\pr` Generic projection `\pr \colon E \to M`: $\mathrm{pr}\colon E \to M$
Uses `operatorfont`.

`\inv` Inversion map `\inv \colon g \mapsto g^{-1}`: $\mathrm{inv}\colon g \mapsto g^{-1}$
Uses `operatorfont`.

`\ev` Evaluation map `\ev \colon V \tensor V^* \to \mathbb{k}`: $\mathrm{ev}\colon V \otimes V^* \to \Bbbk$
Uses `operatorfont`.

`\image` Image of a map `\image(f)`: $\mathrm{im}(f)$
Uses `operatorfont`.

`\graph` Graph of a map `\graph(f)`: $\mathrm{graph}(f)$
Uses `operatorfont`.

`\coimage` Coimage of a map `\coimage(f)`: $\mathrm{coim}(f)$
Uses `operatorfont`.

`\coker` Cokernel of a map `\coker(f)`: $\mathrm{coker}(f)$
Uses `operatorfont`.

`\operator` This macro allows to construct own mathematical operators whose fonts are consistent with the predefined operators of `nchairx \operator{asso}`: asso
Uses `operatorfont`.

2.3.4 Relations

`\later` Later in a directed set `i \later j`: $i \succcurlyeq j$

`\earlier` Earlier in a directed set `i \earlier j`: $i \preccurlyeq j$

2.3.5 Big Sums and Products

`\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`: $+_{k=1}^{n} V_k$ and in displaystyle:

$$\bigplus_{k=1}^{n} V_k$$

`\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`: $\times_{k=1}^{n} V_k$ and in displaystyle:

$$\bigtimes_{k=1}^{n} V_k$$

`\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`: $\prod_{k=1}^n V_k$ and in displaystyle:

$$\prod_{k=1}^{n} V_k$$

2.3.6 Labels

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

`\smiley` A smiley `\smiley` ☺

`\frownie` A frownie `\frownie` ☹

`\heart` A heart `\heart` ♡

2.4 Algebra

2.4.1 Fonts for Rings and Things

`\field` Font for rings `\field{R}`: $\mathbb{R}$
Uses `fieldfont`.

`\ring` Font for rings `\ring{C}`: C
Uses `ringfont`.

`\group` Font for particular (matrix) groups `\group{SO}(3)`: $\mathrm{SO}(3)$
Uses `groupfont`.

`\algebra` Font for algebras `\algebra{A}`: $\mathscr{A}$
Uses `algebrafont`.

`\module` Font for modules `\module{M}`: $\mathscr{M}$
Uses `modulefont`.

`\liealg` Font for Lie algebras `\liealg{g}`: $\mathfrak{g}$
Uses `liealgfont`.

`\MC` MC for Maurer-Cartan as a tiny index `\mu_\MC \in \liealg{g}^1`: $\mu_{\mathrm{MC}} \in \mathfrak{g}^1$
Uses `scriptfont`.

`\gerstenhaber` Font for Gerstenhaber algebras `\gerstenhaber{G}`: $\mathfrak{G}$
Uses `gerstenhaberfont`.

2.4.2 Some Symbols needed in Algebra

`\Pol` Polynomials and polynomial functions `\Pol(T^*Q)`: $\mathrm{Pol}(T^*Q)$
Uses `operatorfont`.

`\lmult` Left multiplications `\lmult_a`: ℓ_a
Uses `operatorfont`.

`\rmult` Right multiplications `\rmult_b`: r_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})`: $\mathfrak{Z}(\mathcal{A})$

`\ad` Adjoint action (infinitesimal) `\ad(a)`: $\mathrm{ad}(a)$
Uses operatorfont.

`\Ad` Adjoint action `\Ad_g`: Ad_g
Uses operatorfont.

`\Conj` Conjugation `\Conj_g`: Conj_g
Uses operatorfont.

`\acts` A generic (left) action map `g \acts a`: $g \triangleright a$

`\racts` A generic right action map `a \racts g`: $a \triangleleft g$

`\Char` Characteristics of a field `\Char(\mathbb{k})`: $\mathrm{char}(\Bbbk)$
Uses operatorfont.

`\modulo` Yet another modulo `n \modulo 2`: $n \bmod 2$
Uses operatorfont.

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

`\cClifford` Complex Clifford algebra `\cClifford(V, h)`: $\mathbb{C}\mathrm{l}(V, h)$
Uses operatorfont.

`\Der` ($*$-)Derivations `\Der(\algebra{A})`: $\mathrm{Der}(\mathcal{A})$
`\Der*(\algebra{A})`: ${}^*\text{-}\mathrm{Der}(\mathcal{A})$
Uses operatorfont.

`\InnDer` Inner ($*$-)derivations `\InnDer(\algebra{A})`: $\mathrm{InnDer}(\mathcal{A})$
`\InnDer*(\algebra{A})`: ${}^*\text{-}\mathrm{InnDer}(\mathcal{A})$
Uses operatorfont.

`\OutDer` Outer ($*$-)derivations `\OutDer(\algebra{A})`: $\mathrm{OutDer}(\mathcal{A})$
`\OutDer*(\algebra{A})`: ${}^*\text{-}\mathrm{OutDer}(\mathcal{A})$
Uses operatorfont.

`\InnAut` Inner ($*$-)automorphisms `\InnAut(\algebra{A})`: $\mathrm{InnAut}(\mathcal{A})$
`\InnAut*(\algebra{A})`: ${}^*\text{-}\mathrm{InnAut}(\mathcal{A})$
Uses operatorfont.

`\OutAut` Outer ($*$-)automorphisms `\OutAut(\algebra{A})`: $\mathrm{OutAut}(\mathcal{A})$
`\OutAut*(\algebra{A})`: ${}^*\text{-}\mathrm{OutAut}(\mathcal{A})$
Uses operatorfont.

`\formal` Formal power series in some variables `V\formal{\lambda}`: $V[\![\lambda]\!]$

`\laurent` Formal Laurent series in some variables `V\laurent{\lambda}`: $V(\!(\lambda)\!)$

`\sweedler` Smaller index for Sweedler notation in Hopf algebra theory
`\Delta(a) = a_\sweedler{1} \tensor a_\sweedler{2}`: $\Delta(a) = a_{(1)} \otimes a_{(2)}$

2.4.3 Categories from Algebra

`\algebras` Category of algebras `\algebras`: alg
Category of $*$-algebras `\algebras*`: ${}^*\mathsf{alg}$
Uses categorynamefont.

`\Algebras` Category of unital algebras `\Algebras`: Alg

Category of unital $*$-algebras `\Algebras*`: *-Alg
Uses `categorynamefont`.

`\reps` Category of ($*$-)representations `\reps_\algebra{C}(\algebra{B})`: $\mathsf{rep}_{\mathscr{C}}(\mathscr{B})$
`\reps*_\algebra{C}(\algebra{B})`: *-$\mathsf{rep}_{\mathscr{C}}(\mathscr{B})$
Uses `categorynamefont`.

`\Reps` Category of strongly non-degenerate (*)-representations `\Reps_\algebra{A}(\algebra{B})`:$\mathsf{Rep}_{\mathscr{A}}(\mathscr{B})$
`\Reps*_\algebra{A}(\algebra{B})`:*-$\mathsf{Rep}_{\mathscr{A}}(\mathscr{B})$
Uses `categorynamefont`.

`\PoissonAlg` Category of ($*$-)Poisson algebras `\PoissonAlg`: PoissonAlg
`\PoissonAlg*`: *-PoissonAlg
Uses `categorynamefont`.

`\modules` Category of (inner product) modules `\modules_\algebra{A}(\algebra{B})`:
$\mathsf{mod}_{\mathscr{A}}(\mathscr{B})$
`\modules*_\algebra{A}(\algebra{B})`: *-$\mathsf{mod}_{\mathscr{A}}(\mathscr{B})$
Uses `categorynamefont`.

`\Leftmodules` Category of left modules `\Leftmodules{\algebra{A}}`: $\mathscr{A}$-mod
Uses `categorynamefont`.

`\Rightmodules` Category of right modules with optional subscript `\Rightmodules[\category{C}]{\algebra{A}}`:
$\mathsf{mod}_{\mathfrak{C}}$-$\mathscr{A}$
Uses `categorynamefont`.

`\Modules` Category of strongly non-degenerate (inner product) modules `\Modules_\algebra{A}(\algebra{B})`:
$\mathsf{Mod}_{\mathscr{A}}(\mathscr{B})$
`\Modules*_\algebra{A}(\algebra{B})`: *-$\mathsf{Mod}_{\mathscr{A}}(\mathscr{B})$
Uses `categorynamefont`.

`\LeftModules` Category of strongly non-degenerate left modules `\LeftModules{\algebra{A}}`:
$\mathscr{A}$-Mod
Uses `categorynamefont`.

`\RightModules` Category of strongly non-degenerate right modules with optional subscript
`\RightModules{\algebra{A}}`: Mod-$\mathscr{A}$ or `\RightModules[\category{C}]{\algebra{A}}`:
$\mathsf{Mod}_{\mathfrak{C}}$-$\mathscr{A}$
Uses `categorynamefont`.

`\Bimodules` Category of (inner product) bimodules `\Bimodules(\algebra{A},\algebra{B})`:
$\mathsf{Bimod}(\mathscr{A},\mathscr{B})$
`\Bimodules*(\algebra{A},\algebra{B})`: *-$\mathsf{Bimod}(\mathscr{A},\mathscr{B})$
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
Uses categorynamefont.

\GSets Category of G-Sets \GSets: G-Set and \Gsets[H]: H-Set
Uses categorynamefont.

\Groupoids Category of groupoids \Groupoids: Groupoid
Uses categorynamefont.

2.5 Analysis

2.5.1 General Anyalsis Macros

\vol Volume \vol: vol
Uses operatorfont

\complete Completion of some space \complete{V}: $\widehat{V}$

\Ball Open ball \Ball_{r}(p): $\mathrm{B}_r(p)$

\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: $f(t) \overset{t\to 0}{\sim} t^k$,
or with optional stretching factor (default is 2.5) a \expands[4] b: $a \overset{\sim}{\sim} b$.

2.5.2 Pseudodifferential Operators

\std Standard ordering as small subscript \sigma_\std: σ_{std}
Uses scriptfont

\Weyl Weyl ordering as small subscript \sigma_\Weyl: σ_{Weyl}
Uses scriptfont

\Op Operator for a symbol \Op(f): $\mathrm{Op}(f)$
Uses operatorfont

\Opstd Standard ordered operator for a symbol \Opstd(f): $\mathrm{Op}_{\mathrm{std}}(f)$
Uses operatorfont

\OpWeyl Weyl ordered operator for a symbol \OpWeyl(f): $\mathrm{Op}_{\mathrm{Weyl}}(f)$
Uses operatorfont

2.5.3 Function Spaces

\spacename Font for specific functional spaces \spacename{F}(X): $\mathscr{F}(X)$
Uses spacefont.

\Bounded Bounded functions \Bounded(X): $\mathscr{B}(X)$
Uses spacefont.

\Continuous Continuous functions \Continuous(X): $\mathscr{C}(X)$

Uses spacefont.

`\Contbound` Continuous bounded functions `\Contbound(X)`: $\mathscr{C}_{\mathrm{b}}(X)$
Uses spacefont.

`\Fun` C^k-functions (for $\mathscr{C}$ use `\Continuous`) `\Fun(M)`: $\mathscr{C}^k(M)$ and `\Fun[\ell](M)`: $\mathscr{C}^\ell(M)$
Uses spacefont.

`\Cinfty` Smooth functions `\Cinfty`: $\mathscr{C}^\infty(M)$
Uses spacefont.

`\Comega` Real-analytic functions `\Comega`: $\mathscr{C}^\omega(M)$
Uses spacefont.

`\Holomorphic` Holomorphic functions `\Holomorphic`: $\mathscr{O}(U)$
Uses spacefont.

`\AntiHolomorphic` Anti-holomorphic functions `\AntiHolomorphic`: $\overline{\mathscr{O}}(U)$
Uses spacefont.

`\Schwartz` Schwartz space `\Schwartz`: $\mathscr{S}(\mathbb{R}^n)$
Uses spacefont.

`\Riemann` Riemann integrable functions `\Riemann([a, b])`: $\mathscr{R}([a,b])$
Uses spacefont.

2.5.4 Locally Convex Analysis and Distributions

`\singsupp` Singular support of a distribution `\singsupp u`: $\operatorname{sing\,supp} u$

`\seminorm` Font for generic seminorm `\seminorm{p}`: p

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

`\conv` Convex hull `\conv(A)`: $\operatorname{conv}(A)$

`\extreme` Extreme points `\extreme(A)`: $\operatorname{extreme}(A)$

2.5.5 Hilbert Spaces and Operators

`\hilbert` Font for Hilbert spaces `\hilbert{H}`: $\mathfrak{H}$
Uses hilbertfont

`\prehilb` Font for pre-Hilbert spaces `\prehilb{H}`: $\mathcal{H}$
Uses prehilbfont.

`\Adjointable` Adjointable operators `\Adjointable(\hilbert{H})`: $\mathfrak{B}(\mathfrak{H})$ or with optional argument `\Adjointable[\algebra{A}](\hilbert{H})`: $\mathfrak{B}_{\mathscr{A}}(\mathfrak{H})$ if we have a Hilbert module over an algebra $\mathscr{A}$ instead.

`\Finite` Finite rank operators `\Finite(\hilbert{H})`: $\mathfrak{F}(\mathfrak{H})$ or with optional argument `\Finite[\algebra{A}](\module{H})`: $\mathfrak{F}_{\mathscr{A}}(\mathscr{H})$

`\Compact` Compact operators `\Compact(\hilbert{H})`: $\mathfrak{K}(\mathfrak{H})$ or with optional argument `\Compact[\algebra{A}](\module{H})`: $\mathfrak{K}_{\mathscr{A}}(\mathscr{H})$

`\opdomain` Domain of definition of an operator `\opdomain(A)`: $\mathfrak{D}(A)$
Uses \hilbertfont.

`\spec` Spectrum of an operator `\spec(A)`: $\operatorname{spec}(A)$
Uses operatorfont.

`\closure` Closure of an operator `\closure{A}`: $\overline{A}$

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

Uses `operatorfont`.

`\Res` Resolvent of an operator `\Res_z(A)`: $\mathrm{Res}_z(A)$
Uses `operatorfont`.

`\specrad` Spectral radius of an operator `\specrad(A)`: $\varrho(A)$

`\slim` Strong limit `\slim_{n \longrightarrow \infty} A_n`: s-$\lim_{n\longrightarrow\infty} A_n$

`\wlim` Weak limit `\wlim_{n \longrightarrow \infty} A_n`: w-$\lim_{n\longrightarrow\infty} A_n$

2.5.6 Dirac's Bra and Ket Notation

`\bra` Dirac bra `\bra{\psi}`: $\langle\psi|$

`\ket` Dirac ket `\ket{\phi}`: $|\phi\rangle$

`\braket` Dirac braket `\braket{\phi}{\psi}`: $\langle\phi\,|\,\psi\rangle$

`\ketbra` Dirac ketbra `\ketbra{\phi}{\psi}`: $|\phi\rangle\langle\psi|$

2.5.7 Operator Algebras

`\Spec` Spectrum of an algebra `\Spec(\algebra{A})`: $\mathrm{Spec}(\mathscr{A})$
Uses `operatorfont`.

`\Rad` Radical of an algebra `\Rad(\algebra{A})`: $\mathrm{Rad}(\mathscr{A})$
Uses `operatorfont`.

`\ind` Fredholm index (`\index` is already used!) `\ind(A)`: $\mathrm{ind}(A)$
Uses `operatorfont`.

2.5.8 Measure Theory and Integration

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

`\Measurable` Measurable functions `\Measurable(X)`: $\mathscr{M}(X)$
Uses `operatorfont`.

`\Meas` Complex measures `\Meas(X)`: $\mathrm{Meas}(X)$
Uses `operatorfont`.

`\BoundMeas` Bounded measurable functions `\BoundMeas(X)`: $\mathscr{BM}(X)$
Uses `spacefont`.

`\Lp` Equivalence classes of p-integrable functions (p is an optional argument) `\Lp(X)`: $\mathrm{L}^p(X)$ and `\Lp[q](X)`: $\mathrm{L}^q(X)$

`\Lone` Equivalence classes of integrable functions `\Lone(X)`: $\mathrm{L}^1(X)$

`\Ltwo` Equivalence classes of square integrable functions `\Ltwo(X)`: $\mathrm{L}^2(X)$

`\Linfty` Equivalence classes of essentially bounded functions `\Linfty(X)`: $\mathrm{L}^\infty(X)$

`\Intp` Space of p-integrable functions `\Intp(X)`: $\mathscr{L}^p(X)$ and with optional argument `\Intp[q](X)`: $\mathscr{L}^q(X)$

`\Intone` Space of integrable functions `\Intone(X)`: $\mathscr{L}^1(X)$

`\Inttwo` Space of square integrable functions `\Inttwo(X)`: $\mathscr{L}^2(X)$

`\Intinfty` Space of essentially bounded functions `\Intinfty(X)`: $\mathscr{L}^\infty(X)$

`\essrange` Essential range `\essrange(f)`: $\operatorname{ess\,range}(f)$
Uses `operatorfont`.

`\esssup` Essential supremum `\esssup(f)`: $\operatorname{ess\,sup}(f)$

Uses operatorfont.

`\esssupnorm` Essential supremum norm `\esssupnorm{f}`: $\|f\|_{\text{ess sup}}$
Uses operatorfont.

`\ac` Absolutely continuous part of a measure `\mu_\ac`: μ_{ac}
Uses scriptfont.

`\sing` Singular part of a measure `\mu_\sing`: μ_{sing}
Uses scriptfont.

2.5.9 Limits

`\indlim` Inductive (or direct) limit `\indlim_{i \in I} A_i`: $\operatorname{ind\,lim}_{i\in I} A_i$
Uses operatorfont.

`\projlim` Projective (or inverse) limit `\projlim_{i \in I} A_i`: $\operatorname{proj\,lim}_{i\in I} A_i$
Uses operatorfont.

2.6 Category Theory

2.6.1 General Category Theory

`\category` Font for generic categories `\category{C}`: $\mathfrak{C}$
Uses categoryfont.

`\categoryname` Font for specific categories `\categoryname{FinSet}`: FinSet
Uses categorynamefont.

`\functor` Font for functors `\functor{F}`: F
Uses functorfont.

`\groupoid` Font for groupoids `\groupoid{G}`: $\mathfrak{G}$
Uses groupoidfont.

`\source` Source of arrow `\source(f)`: source(f)
Uses operatorfont.

`\target` Target of arrow `\target(f)`: target(f)
Uses operatorfont.

`\unit` Unit map in groupoids `\unit\colon M \longrightarrow G`: unit: $M \longrightarrow G$
Uses operatorfont.

`\opp` Opposite category etc. `\category{C}^\opp`: $\mathfrak{C}^{\text{opp}}$
Uses scriptfont.

`\asso` Natural transformation of associativity `\asso`: asso
Uses operatorfont.

`\Hom` Homomorphisms `\Hom(A, B)`: $\operatorname{Hom}(A, B)$
Uses operatorfont.

`\End` Endomorphisms `\End(E)`: $\operatorname{End}(E)$
Uses operatorfont.

`\Aut` ($*$-)Automorphisms `\Aut(A)`: $\operatorname{Aut}(A)$
`\Aut*(A)`: $^*\text{-}\operatorname{Aut}(A)$
Uses operatorfont.

`\Iso` ($*$-)Isomorphisms `\Iso(A, B)`: $\operatorname{Iso}(A, B)$

`\Iso*(A, B)`: *-$\mathrm{Iso}(A,B)$
Uses `operatorfont`.

`\Obj` Objects of a category `\Obj(\category{C})`: $\mathrm{Obj}(\mathfrak{C})$
Uses `operatorfont`.

`\Morph` Morphisms of a category `\Morph(a, b)`: $\mathrm{Morph}(a,b)$
Uses `operatorfont`.

2.6.2 Colimits

`\colim` Colimits of diagrams or functors: `\colim \functor{F}`: $\operatorname{colim}\mathsf{F}$

2.7 Differential Geometry

2.7.1 General Macros in Differential Geometry

`\Lie` Lie derivative `\Lie_X f`: $\mathscr{L}_X f$

`\Schouten` Schouten bracket `\Schouten{X,Y}`: $[\![X,Y]\!]_{\mathrm{S}}$.

`\Forms` Differential forms `\Forms(M)`: $\Omega(M)$

`\ZdR` DeRham cocycles `\ZdR(M, \mathbb{C})`: $\mathrm{Z}_{\mathrm{dR}}(M,\mathbb{C})$
Uses `operatorfont`.

`\BdR` DeRham coboundaries `\BdR(M, \mathbb{C})`: $\mathrm{B}_{\mathrm{dR}}(M,\mathbb{C})$
Uses `operatorfont`.

`\HdR` DeRham cohomology `\HdR(M, \mathbb{C})`: $\mathrm{H}_{\mathrm{dR}}(M,\mathbb{C})$
Uses `operatorfont`.

`\Diffeo` Diffeomorphism group `\Diffeo(M)`: $\mathrm{Diffeo}(M)$
Uses `operatorfont`.

`\Diffop` Differential operators `\Diffop(M)`: $\mathrm{DiffOp}(M)$
Uses `operatorfont`.

`\loc` To be used as an index `M_\loc`: M_{loc}
Uses `scriptfont`.

`\germ` Germs of functions `\germ_p(f)`: $\mathrm{germ}_p(f)$
Uses `operatorfont`.

`\prol` Prolongation map `\prol(f)`: $\mathrm{prol}(f)$
Uses `operatorfont`.

`\NRbracket` Nijenhuis-Richardson bracket `\NRbracket{a, b}`: $[a,b]_{\mathrm{NR}}$
Uses `scriptfont`.

`\FNbracket` Fröhlicher-Nijenhuis bracket `\FNbracket{a, b}`: $[a,b]_{\mathrm{FN}}$
Uses `scriptfont`.

`\Manifolds` The category of manifolds `\Manifolds`: Manifold
Uses `categorynamefont`

2.7.2 Lie Groups and Principal Fiber Bundles

`\lefttriv` Left trivialization `\lefttriv`: left
Uses `operatorfont`.

`\righttriv` Right trivialization `\righttriv`: right
Uses `operatorfont`.

`\Gau` Gauge group `\Gau(P)`: $\mathrm{Gau}(P)$
Uses `operatorfont`.

`\Conn` Connection one-forms `\Conn(P)`: $\mathrm{Conn}(P)$
Uses `operatorfont`.

`\ratio` Ratio map of principal fiber bundle `\ratio(u, v)`: $\mathrm{r}(u, v)$
Uses `operatorfont`.

`\Parallel` Parallel transport `\Parallel_{0 \to 1, \gamma}(v)`: $\mathrm{P}_{0\to 1,\gamma}(v)$
Uses `operatorfont`.

`\CE` Chevalley-Eilenberg as index `C_\CE`: C_{CE}
Uses `scriptfont`.

`\HCE` Chevalley-Eilenberg cohomology `\HCE(\liealg{g})`: $\mathrm{H}_{\mathrm{CE}}(\mathfrak{g})$
Uses `operatorfont`.

`\fund` Trivialization by fundamental vector fields `\fund`: fund
Uses `operatorfont`.

`\Universal` Universal enveloping algebra `\Universal{\liealg{g}}`: $\mathrm{U}(\mathfrak{g})$
Uses `operatorfont`.

`\BCH` BCH as small index `\sigma_\BCH`: σ_{BCH}
Uses `scriptfont`.

`\LieGroups` The category of Lie groups `\LieGroups`: LieGroup
Uses `categorynamefont`.

`\Principal` The category of principal bundles `\Principal`: Principal
Uses `categorynamefont`.

`\GPrincipal` The category of G-principal bundles `\GPrincipal`: G-Principal
or with optional structure group `\GPrincipal[H]`: H-Principal
Uses `categorynamefont`.

`\Fiber` The category of fiber bundles `\Fiber`: Fiber Uses `categorynamefont`.

`\FFiber` The category of fiber bundles with typical fiber `\FFiber`: F-Fiber
or with specified typical fiber `\FFiber[X]`: X-Fiber
Uses `categorynamefont`.

`\Pin` The pin group `\Pin(q, p)`: $\mathrm{Pin}(p, q)$
Uses `groupfont`.

`\Spin` The spin group `\Spin(q, p)`: $\mathrm{Spin}(p, q)$
Uses `groupfont`.

2.7.3 (Pseudo-) Riemannian Geometry

`\nablaLC` Levi-Civita covariant derivative `\nablaLC_X Y`: $\nabla^{\mathrm{LC}}_X Y$
Uses `scriptfont`.

`\Laplace` Laplace operator `\Laplace f`: Δf

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

`\feynman` Feynman slash notation `\feynman{D} = \feynman{A} + \feynman{\partial}`: $\not{D} = \not{A} + \not{\partial}$

`\Dirac` Dirac operator `\Dirac u`: $\not{D}u$

`\rotation` Rotation (i.e. curl) of a vector field `\rotation(X)`: $\mathrm{rot}(X)$. Not to be confused with $\mathrm{grün}(X)$.
Uses `operatorfont`.

`\curl` Curl of a vector field `\curl \vec{X}`: $\operatorname{curl}\vec{X}$
Uses `operatorfont`.

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

`\gradient` Gradient of a function `\gradient f`: $\operatorname{grad} f$
Uses `operatorfont`.

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

`\Ric` Ricci curvature `\Ric (X, Y)`: $\operatorname{Ric}(X,Y)$
Uses `operatorfont`.

`\scal` Scalar curvature `\scal`: scal
Uses `operatorfont`.

`\Riem` The set of Riemannian metrics (linear and on manifolds) `\Riem(M)`: $\operatorname{Riem}(M)$
Uses `operatorfont`.

`\Hessian` Hessian of a function `\Hessian(f) \in \Secinfty(\Sym^2T^*M)`: $\operatorname{Hessian}(f) \in \Gamma^\infty(\mathrm{S}^2T^*M)$
Uses `operatorfont`.

`\hodge` Hodge star operator `\alpha \mapsto \hodge\alpha`: $\alpha \mapsto \star\alpha$

2.7.4 Complex Geometry

`\Nijenhuis` Nijenhuis operator `\Nijenhuis(X, Y)`: $\operatorname{Nij}(X,Y)$
Uses `operatorfont`.

`\del` Dolbeault operator `\del \omega`: $\partial\omega$

`\delbar` CC of Dolbeault operator `\delbar\alpha`: $\overline{\partial}\alpha$

`\FS` Fubini Study as very small index `\omega_\FS`: ω_{FS}
Uses `scriptfont`.

2.7.5 Vector Bundles

`\Lift` Generic lift of something `\nabla^\Lift`: ∇^{Lift}
Uses `scriptfont`.

`\ver` Vertical lift `X^\ver`: X^{ver}
Uses `scriptfont`.

`\hor` Horizontal lift `X^\hor`: X^{hor}
Uses `scriptfont`.

`\Ver` Vertical subbundle `\Ver(E)`: $\operatorname{Ver}(E)$
Uses `operatorfont`.

`\Hor` Horizontal subbundle `\Hor(E)`: $\operatorname{Hor}(E)$
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)`: $\Gamma_{\mathrm{hol}}(U,E)$
Uses `scriptfont`.

`\SymD` Symmetrized covariant derivative `\SymD^n f`: $\mathrm{D}^n f$
Uses `operatorfont`.

`\Densities` Densities of a vector bundle of rank n or specific rank `\Densities TM`: $|\Lambda^n|TM$ and `\Densities[k]^\alpha E`: $|\Lambda^k|^\alpha E$.

`\MeasurableSections` Measurable sections `\MeasurableSections(E)`: $\mathscr{M}\Gamma(E)$
Uses `spacefont`.

`\IntpSections` p-Integrable Sections `\IntpSections(\Densities T^*M)`: $\mathscr{L}^p\Gamma(|\Lambda^n|T^*M)$ or with optional argument `\IntpSections[q](\Densities T^*M)`: $\mathscr{L}^q\Gamma(|\Lambda^n|T^*M)$.

`\IntegrableSections` Integrable sections `\IntegrableSections(\Densities T^*M)`: $\mathscr{L}^1\Gamma(|\Lambda^n|T^*M)$

`\Translation` Fiber translations `\Translation_A`: T_A
Uses `operatorfont`.

`\frames` Font for local frames `\frames{e}_1, \ldots, \frames{e}_k`: $\mathrm{e}_1, \ldots, \mathrm{e}_k$
Uses `operatorfont`.

`\Frames` Frame bundle of a vector bundle `\Frames(E) \longrightarrow M`: $\mathrm{Frames}(E) \longrightarrow M$
Uses `operatorfont`.

`\FDiff` Fiber derivative `\FDiff L`: $\mathrm{F}L$
Uses `operatorfont`.

2.7.6 Symplectic and Poisson Geometry

`\Sympl` Symplectomorphism group `\Sympl(M, \omega)`: $\mathrm{Sympl}(M, \omega)$
Uses `groupfont`.

`\Jacobiator` Jacobiator `\Jacobiator`: Jac_π and `\Jacobiator[\nu]`: Jac_ν
Uses `operatorfont`.

`\red` Reduced as an index `M_\red`: M_{red}
Uses `scriptfont`.

`\Hess` Hess map `\Hess`: $\mathrm{Hess}(\nabla)$
Uses `operatorfont`.

`\KKS` KKS as tiny index `\{f, g\}_\KKS`: $\{f, g\}_{\mathrm{KKS}}$
Uses `scriptfont`.

`\Courant` Courant bracket `\Courant{a, b}`: $[\![a, b]\!]_{\mathrm{C}}$
Uses `scriptfont`.

`\Dorfman` Dorfman bracket `\Dorfman{(x, \xi), (y, \eta)}`: $[\![(x, \xi), (y, \eta)]\!]_{\mathrm{D}}$
Uses `scriptfont`

`\Dir` (Linear) Dirac structures `\Dir(V)`: $\mathrm{Dir}(V)$
Uses `operatorfont`.

`\Forward` Forward map `\Forward(\phi)`: $\mathcal{F}(\phi)$

`\Backward` Backward map `\Backward(\phi)`: $\mathcal{B}(\phi)$

`\Tangent` Generalized tangent bundle/map `\Tangent M`: $\mathbb{T}M$

`\MWreduction` Marsden-Weinstein reduction `M \MWreduction G`: $M /\!\!/ G$

`\Mon` Monodromy groupoid `\Mon(M)`: $\mathrm{Mon}(M)$
Uses `operatorfont`.

`\Hol` Holonomy groupoid `\Hol(M)`: $\mathrm{Hol}(M)$
Uses `operatorfont`.

2.8 Linear Algebra

2.8.1 General Linear Algebra

`\tr` Trace of a linear map `\tr(A)`: $\mathrm{tr}(A)$
Uses `operatorfont`.

`\rank` Rank of a linear map `\rank(A)`: $\mathrm{rank}(A)$
Uses `operatorfont`.

`\codim` Codimension `\codim U`: $\operatorname{codim} U$
Uses `operatorfont`.

`\diag` Diagonal (for filling matrices etc.) `\diag(1,-1, -1)`: $\mathrm{diag}(1,-1,-1)$
Uses `operatorfont`.

`\Trans` Transposition of matrices `A^\Trans`: A^{T}
Uses `scriptfont`.

`\Mat` Matrices `\Mat_n(\mathbb{R})`: $\mathrm{M}_n(\mathbb{R})$
Uses `operatorfont`.

`\SymMat` Symmetric matrices `\SymMat_n(\mathbb{R})`: $\mathrm{SymMat}_n(\mathbb{R})$
Uses `operatorfont`.

`\ann` Annihilator of a subspace `U^\ann`: U^{ann}
Uses `scriptfont`.

`\Span` Span of something `\Span\{v, u\}`: $\mathrm{span}\{v,u\}$ and with optional argument `\Span[\mathbb{C}]\{v,u\}`: $\mathrm{span}_{\mathbb{C}}\{v,u\}$
Uses `operatorfont`.

`\basis` Font for basis vectors `\basis{e}_i`: e_i
Uses `basisfont`.

2.8.2 Tensors

`\tensor` Generic tensor product over some ring `a \tensor b`: $a \otimes b$.
With optional subscript `V \tensor[\algebra{A}] U`: $V \otimes_{\mathcal{A}} U$

`\Tensor` Tensor powers, tensor algebra `\Tensor^\bullet(V)`: $\mathrm{T}^\bullet(V)$
Uses `operatorfont`.

`\Anti` Antisymmetric tensor powers, Grassmann algebra `\Anti(V)`: $\Lambda(V)$

`\Sym` Symmetric tensor powers, symmetric algebra `\Sym^\bullet(V)`: $\mathrm{S}^\bullet(V)$
Uses `operatorfont`.

`\Symmetrizer` Symmetrizer `\Symmetrizer_n`: Sym_n

`\AntiSymmetrizer` Anti-symmetrizer `\AntiSymmetrizer`: Alt

`\ins` Generic insertion map `\ins_X`: i_X
Uses `operatorfont`.

`\jns` Generic right insertion map `\jns_X`: j_X
Uses `operatorfont`.

`\insa` Antisymmetric insertion map `\insa(X)`: $\mathrm{i}_{\mathrm{a}}(X)$
Uses `operatorfont`, `scriptfont`.

`\inss` Symmetric insertion map `\inss(v)`: $\mathrm{i}_{\mathrm{s}}(v)$
Uses `operatorfont`, `scriptfont`.

`\dega` Antisymmetric degree `\dega(a) = ka`: $\deg_{\mathrm{a}}(a) = ka$
Uses `operatorfont`, `scriptfont`.

`\degs` Symmetric degree `\degs(X) = \ell X`: $\deg_{\mathrm{s}}(X) = \ell X$
Uses `operatorfont`, `scriptfont`.

2.8.3 Inner Products

`\SP` Simple scalar product `\SP{x, y}`: $\langle x, y \rangle$.
`\littlepara` Small parallel to be used as a subscript `v_\littlepara`: $v_{\shortparallel}$
`\IP` Generic inner product with five arguments to decorate it `\IP[]{}{}{}{}{}` and an optional argument to adjust the size:

$$ {}_{B}\big\langle z, w \big\rangle_{R}^{\perp} \quad \text{and} \quad {}_{\mathscr{B}}^{\perp}\Big\langle \prod x_i, y \Big\rangle_{\mathscr{A}}^{\prime} $$

2.9 Statistics

2.9.1 Macros for General Statistics

`\EX` Expectation value `\EX_\omega(A)`: $\mathrm{E}_{\omega}(A)$
Uses `operatorfont`.
`\Var` Variance `\Var(a)`: $\mathrm{Var}(a)$
Uses `operatorfont`.
`\Cov` Covariance `\Cov_\omega(a, b)`: $\mathrm{Cov}_{\omega}(a, b)$
Uses `operatorfont`.
`\Cor` Correlation `\Cor(a, b)`: $\mathrm{Cor}(a, b)$
Uses `operatorfont`.

2.10 Topology

2.10.1 Macros for Topology

`\cl` Topological closure `X^\cl`: X^{cl}
Uses `scriptfont`.
`\scl` Sequential closure `A^\scl`: A^{scl}
Uses `scriptfont`.
`\interior` Open interior `A^\interior`: A°
`\boundary` Boundary of a subset `\boundary A`: ∂A
`\supp` Support of a function `\supp f`: $\operatorname{supp} f$
Uses `operatorfont`.
`\dist` Distance `\dist(p, A)`: $\operatorname{dist}(p, A)$
Uses `operatorfont`.
`\topology` Font for topology `\topology{M}`: $\mathscr{M}$
Uses `topologyfont`.
`\filter` Font for filter `\filter{F}`: $\mathfrak{F}$
Uses `filterfont`.
`\sheaf` Font for sheaves `\sheaf{F}`: $\mathscr{F}$
Uses `sheaffont`.

`\Sections` Discontinuous sections of a presheaf `\Sections(\sheaf{F})`: Sections($\mathscr{F}$)
Uses `operatorfont`.

`\HOM` Sheaf of morphisms between sheaves `\HOM(\sheaf{F}, \sheaf{G})`: $\mathscr{H}om(\mathscr{F},\mathscr{G})$
Uses `sheaffont` and `\mathit`.

`\etale` Étalé space of presheaf `\etale{\sheaf{F}}`: $|\mathscr{F}|$.

2.10.2 Categories from Topology

`\topological` Category of topological spaces `\topological`: top
Uses `categoryname`.

`\Topological` Category of Hausdorff topological spaces `\Topological`: Top
Uses `categoryname`.

`\Sheaves` Category of sheaves over a space `\Sheaves(M)`: Sheaves(M)
Uses `categoryname`.

`\PreSheaves` Category of presheaves over a space `\PreSheaves(M)`: PreSheaves(M)
Uses `categoryname`.

`\Etale` Category of étalé spaces over a space `\Etale(M)`: Etale(M)
Uses `categoryname`.

3 Implementation

The following packages are required:

```
\RequirePackage{amsmath}
\RequirePackage{amssymb}
\RequirePackage{mathtools}
```

Grab only those fonts from stmry which we actually need

```
\DeclareSymbolFont{stmry}{U}{stmry}{m}{n}
\SetSymbolFont{stmry}{bold}{U}{stmry}{b}{n}
```

```
\RequirePackage{xkeyval}
```

Used for allowing key-value pairs as options.

```
\RequirePackage{tensor}
```

The `suffix` package allows to define $*$-versions of macros.

```
\RequirePackage{suffix}
```

In order to get the package options for `nchairx` working, the following needs to be defined.

```
\newif\if@loadmath \@loadmathtrue
```

3.1 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.

3.1.1 Default Values for some Math Fonts

\mathbb Redefine \mathbb to use the nicer \mathbbm.

```
\DeclareMathAlphabet{\ch@airxmathbbm}{U}{bbm}{m}{n}
\SetMathAlphabet\ch@airxmathbbm{bold}{U}{bbm}{bx}{n}
\renewcommand{\mathbb}[1]{\ch@airxmathbbm{#1}}
```

\mathscr We load a script font and provide the command \mathscr

```
\DeclareMathAlphabet{\mathscr}{U}{rsfso}{m}{n}
```

\mathcal We redefine the \mathcal command using the Euler font.

```
\DeclareSymbolFont{EulerScript}{U}{eus}{m}{n}
\SetSymbolFont{EulerScript}{bold}{U}{eus}{b}{n}
\DeclareSymbolFontAlphabet\mathcal{EulerScript}
```

3.1.2 Setting Fonts for Various Math Groups

Definitions of fonts for the different groups.

\ch@irxalgebrafont
\ch@irxbasisfont
\ch@irxcategoryfont
\ch@irxcategorynamefont
\ch@irxfieldfont
\ch@irxfilterfont
\ch@irxfunctorfont
\ch@irxgerstenhaberfont
\ch@irxgroupfont
\ch@irxgroupoidfont
\ch@irxhilbertfont
\ch@irxliealgfont
\ch@irxmodulefont
\ch@irxprehilbfont
\ch@irxoperatorfont
\ch@irxringfont
\ch@irxscriptfont
\ch@irxsheaffont
\ch@irxspacesfont
\ch@irxtopologyfont

We use xkeyval to define keys setting the different font groups. These keys can be used for the macro \chairxfonts. We use \providecommand to create the font macros if they do not already exist.

```
\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}{filterfont}{
\providecommand{\ch@irxfilterfont}[1]{ }
\renewcommand{\ch@irxfilterfont}{#1}
}
\define@key[chairx]{fonts}{functorfont}{
\providecommand{\ch@irxfunctorfont}[1]{ }
\renewcommand{\ch@irxfunctorfont}{#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}
}
```

Here we need to change the default operatorfont in order to get the chairxoperatorfont also for `\operatorname` and `\DeclareMathOperator`. Note that redefining `\operator@font` with a symbol alphabet and not a symbol font forces us to use an additional bracket in all definitions using `\operatorname` and `\DeclareMathOperator`.

```
\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}{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}
}
```

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 = \mathrm,
    ringfont = \mathsf,
    scriptfont = \mathrm,
    sheaffont = \mathscr,
    spacefont = \mathscr,
    topologyfont = \mathscr
}
```

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 `mathtype` being the optional type of the symbol with default being`\mathord`, `fontname` the name of the font where the symbol is to be found and `glyph` the number of the symbol inside the specified font.

```
\newcommand{\ch@irxfont}[1]{\fontfamily{#1}\fontencoding{U}\fontseries{m}\fontshape{n}\selectfo
\newcommand{\ch@irxsymbol}[2]{{\ch@irxfont{#1}\char#2}}
\newcommand\ch@irxmathsymbol[3][\mathord]{%
  #1{\ch@irxm@thsymbol{#2}{#3}}}
\def\ch@irxm@thsymbol#1#2{\mathchoice
```

```
  {\@ch@irxm@thsymbol{#1}{#2}\tf@size}
  {\@ch@irxm@thsymbol{#1}{#2}\tf@size}
  {\@ch@irxm@thsymbol{#1}{#2}\sf@size}
  {\@ch@irxm@thsymbol{#1}{#2}\ssf@size}}
\def\@ch@irxm@thsymbol#1#2#3{\mbox{\fontsize{#3}{#3}\ch@irxsymbol{#1}{#2}}}
%
\fi
```

3.2 New Delimiters

First we check of macros should be included:

```
\if@loadmath
```

3.2.1 The New Delimiters

\vast \Vast \vastl \vastm \vastr \Vastl \Vastm \Vastr

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

```
\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}

\fi
```

3.3 General Mathematics Macros

First we check of macros should be included:

```
\if@loadmath
```

3.3.1 General Math Commands

\I

```
\newcommand{\I}{\mathrm{i}}
```

\E

```
\newcommand{\E}{\mathrm{e}}
```

\D

```
\newcommand{\D}{\mathop{}\!\mathrm{d}}
```

\cc

```
\newcommand{\cc}[1]{\overline{{#1}}}
```

```
     \sign
           150 \newcommand{\sign}{\operatorname{\ch@irxoperatorfont{sign}}}
       \RE
           151 \newcommand{\RE}{\operatorname{\ch@irxoperatorfont{Re}}}
       \IM
           152 \newcommand{\IM}{\operatorname{\ch@irxoperatorfont{Im}}}
     \Unit
           153 \newcommand{\Unit}{\mathbb{1}}
    \const
           154 \newcommand{\const}{\operatorname{\mathit{const}}}
\canonical
           155 \newcommand{\canonical}{\ch@irxscriptfont{can}}
       \pt
           156 \newcommand{\pt}{\ch@irxoperatorfont{pt}}
```

3.3.2 Restrictions

```
       \at
           157 \newcommand{\at}[2][\big]{#1\vert_{#2}}
```

3.3.3 Maps and Related Stuff

```
      \Map
           158 \newcommand{\Map}{\ch@irxoperatorfont{Map}}
      \Bij
           159 \newcommand{\Bij}{\ch@irxoperatorfont{Bij}}
 \argument
           160 \newcommand{\argument}{\,\cdot\,}
   \domain
           161 \newcommand{\domain}{\operatorname{\ch@irxoperatorfont{dom}}}
    \range
           162 \newcommand{\range}{\operatorname{\ch@irxoperatorfont{range}}}
       \id
           163 \newcommand{\id}{\operatorname{\ch@irxoperatorfont{id}}}
       \pr
           164 \newcommand{\pr}{\operatorname{\ch@irxoperatorfont{pr}}}
```

\inv

```
\newcommand{\inv}{\operatorname{\ch@irxoperatorfont{inv}}}
```

\ev

```
\newcommand{\ev}{\operatorname{\ch@irxoperatorfont{ev}}}
```

\image

```
\newcommand{\image}{\operatorname{\ch@irxoperatorfont{im}}}
```

\graph

```
\newcommand{\graph}{\operatorname{\ch@irxoperatorfont{graph}}}
```

\coimage

```
\newcommand{\coimage}{\operatorname{\ch@irxoperatorfont{coim}}}
```

\coker

```
\newcommand{\coker}{\operatorname{\ch@irxoperatorfont{coker}}}
```

\operator

```
\newcommand{\operator}[1]{\operatorname{\ch@irxoperatorfont{#1}}}
```

3.3.4 Relations

\later

```
\newcommand{\later}{\mathrel{\succcurlyeq}}
```

\earlier

```
\newcommand{\earlier}{\mathrel{\preccurlyeq}}
```

3.3.5 Sums and Products

\bigop 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\big@p[2][1]{%
\mathop{\vphantom{\sum}\mathpalette\bigop@{{#1}{#2}}}\slimits@
}
\newcommand{\bigop@}[2]{\bigop@@#1#2}
\newcommand{\bigop@@}[3]{%
\vcenter{
\sbox\z@{$#1\sum$}
\hbox{\resizebox{\ifx#1\displaystyle#2\fi\dimexpr\ht\z@+\dp\z@}{!}{$\m@th#3$}}
}
}
```

\bigplus The command \DOTSB is used for correct behaviour of \dots before or after the command.

```
\newcommand{\bigplus}{\DOTSB\big@p{+}}
```

\bigtimes
```
185 \newcommand{\bigtimes}{\DOTSB\big@p{\times}}
```
\biprod
```
186 \newcommand{\biprod}{\DOTSB\big@p{\mathrel{\prod\hspace{-0.4cm}\coprod}}}
```

3.3.6 Labels

Smiley from wasysym

\smiley
```
187 \newcommand{\smiley}{\ch@irxmathsymbol[\mathord]{wasy}{44}}
```

Frownie from wasysym

\frownie
```
188 \newcommand{\frownie}{\ch@irxmathsymbol[\mathord]{wasy}{47}}
```
\heart
```
189 \newcommand{\heart}{\heartsuit}
```
```
190 \fi
```

3.4 Algebra

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

3.4.1 Fonts for Rings and Things

\field
```
192 \newcommand{\field}[1]{\ch@irxfieldfont{#1}}
```
\ring
```
193 \newcommand{\ring}[1]{\ch@irxringfont{#1}}
```
\group
```
194 \newcommand{\group}[1]{\ch@irxgroupfont{#1}}
```
\algebra
```
195 \newcommand{\algebra}[1]{\ch@irxalgebrafont{#1}}
```
\module
```
196 \newcommand{\module}[1]{\ch@irxmodulefont{#1}}
```
\liealg
```
197 \newcommand{\liealg}[1]{\ch@irxliealgfont{#1}}
```

\MC
```
198 \newcommand{\MC}{{\scriptscriptstyle\ch@irxscriptfont{MC}}}
```
\gerstenhaber
```
199 \newcommand{\gerstenhaber}[1] {\ch@irxgerstenhaberfont{#1}}
```

3.4.2 Some Symbols needed in Algebra

\Pol
```
200 \newcommand{\Pol}{\ch@irxoperatorfont{Pol}}
```
\lmult
```
201 \newcommand{\lmult}{\operatorname{\ch@irxoperatorfont{\ell}}}
```
\rmult
```
202 \newcommand{\rmult}{\operatorname{\ch@irxoperatorfont{r}}}
```
\Lmult
```
203 \newcommand{\Lmult}{\operatorname{\ch@irxoperatorfont{L}}}
```
\Rmult
```
204 \newcommand{\Rmult}{\operatorname{\ch@irxoperatorfont{R}}}
```
\Center Needs `mathrsfs` package.
```
205 \newcommand{\Center}{\mathscr{Z}}
```
\ad
```
206 \newcommand{\ad}{\operatorname{\ch@irxoperatorfont{ad}}}
```
\Ad
```
207 \newcommand{\Ad}{\operatorname{\ch@irxoperatorfont{Ad}}}
```
\Conj
```
208 \newcommand{\Conj}{\operatorname{\ch@irxoperatorfont{Conj}}}
```
\acts
```
209 \newcommand{\acts}{\mathbin{\triangleright}}
```
\racts
```
210 \newcommand{\racts}{\mathbin{\triangleleft}}
```
\Char
```
211 \newcommand{\Char}{\ch@irxoperatorfont{char}}
```
\modulo
```
212 \newcommand{\modulo}{\operatorname{\ch@irxoperatorfont{mod}}}
```

```
\Clifford
          213 \newcommand{\Clifford}{\operatorname{\ch@irxoperatorfont{Cl}}}

\cClifford
          214 \newcommand{\cClifford}{\operatorname{\mathbb{C}\ch@irxoperatorfont{l}}}

     \Der
          215 \newcommand{\Der}{\operatorname{\ch@irxoperatorfont{Der}}}
          216 \WithSuffix\newcommand\Der*{\decorate[^*]{\textrm{-}\Der}{}}

  \InnDer
          217 \newcommand{\InnDer}{\operatorname{\ch@irxoperatorfont{InnDer}}}
          218 \WithSuffix\newcommand\InnDer*{\decorate[^*]{\textrm{-}\InnDer}{}}

  \OutDer
          219 \newcommand{\OutDer}{\operatorname{\ch@irxoperatorfont{OutDer}}}
          220 \WithSuffix\newcommand\OutDer*{\decorate[^*]{\textrm{-}\OutDer}{}}

  \InnAut
          221 \newcommand{\InnAut}{\operatorname{\ch@irxoperatorfont{InnAut}}}
          222 \WithSuffix\newcommand\InnAut*{\decorate[^*]{\textrm{-}\InnAut}{}}

  \OutAut
          223 \newcommand{\OutAut}{\operatorname{\ch@irxoperatorfont{OutAut}}}
          224 \WithSuffix\newcommand\OutAut*{\decorate[^*]{\textrm{-}\OutAut}{}}

  \formal
          225 \newcommand{\formal}[1]{\ch@irxllbbracket #1\ch@irxrrbbracket}

 \laurent
          226 \newcommand{\laurent}[1]{(\!(#1)\!)}

\sweedler
          227 \newcommand{\sweedler}[1]{{\scriptscriptstyle(#1)}}
```

3.4.3 Categories from Algebra

```
\algebras
          228 \newcommand{\algebras}{\categoryname{alg}}
          229 \WithSuffix\newcommand\algebras*{\decorate[^*]{\textrm{-}\algebras}{}}

\Algebras
          230 \newcommand{\Algebras}{\categoryname{Alg}}
          231 \WithSuffix\newcommand\Algebras*{\decorate[^*]{\textrm{-}\Algebras}{}}

    \reps
          232 \newcommand{\reps}{\categoryname{rep}}
          233 \WithSuffix\newcommand\reps*{\decorate[^*]{\textrm{-}\reps}{}}
```

```
      \Reps
234 \newcommand{\Reps}{\categoryname{Rep}}
235 \WithSuffix\newcommand\Reps*{\decorate[^*]{\textrm{-}\Reps}{}}

 \PoissonAlg
236 \newcommand{\PoissonAlg}{\categoryname{PoissonAlg}}
237 \WithSuffix\newcommand\PoissonAlg*{\decorate[^*]{\textrm{-}\PoissonAlg}{}}

    \modules
238 \newcommand{\modules}{\categoryname{mod}}
239 \WithSuffix\newcommand\modules*{\decorate[^*]{\textrm{-}\modules}{}}

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

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

    \Modules
242 \newcommand{\Modules}{\categoryname{Mod}}
243 \WithSuffix\newcommand\Modules*{\decorate[^*]{\textrm{-}\Modules}{}}

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

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

  \Bimodules
246 \newcommand{\Bimodules}{\categoryname{Bimod}}
247 \WithSuffix\newcommand\Bimodules*{\decorate[^*]{\textrm{-}\Bimodules}{}}

      \Rings
248 \newcommand{\Rings}{\categoryname{Ring}}

    \Groups
249 \newcommand{\Groups}{\categoryname{Group}}

        \Ab
250 \newcommand{\Ab}{\categoryname{Ab}}

   \Lattices
251 \newcommand{\Lattices}{\categoryname{Lattice}}

      \Sets
252 \newcommand{\Sets}{\categoryname{Set}}
```

```
    \Vect
253 \newcommand{\Vect}{\categoryname{Vect}}
 \LieAlgs
254 \newcommand{\LieAlgs}{\categoryname{LieAlg}}
  \Posets
255 \newcommand{\Posets}{\categoryname{Poset}}
\Directed
256 \newcommand{\Directed}{\categoryname{Directed}}
   \GSets
257 \newcommand{\GSets}[1][{G}]{{#1}\textrm{-}\Sets}
\Groupoids
258 \newcommand{\Groupoids}{\categoryname{Groupoid}}
259 \fi
```

3.5 Analysis

First we check of macros should be included:

```
260 \if@loadmath
```

3.5.1 General Analysis

```
    \vol
261 \newcommand{\vol}{\ch@irxoperatorfont{vol}}
\complete
262 \newcommand{\complete}[1]{\widehat{#1}}
   \Ball
263 \newcommand{\Ball}{\ch@irxoperatorfont{B}}
    \abs
264 \DeclarePairedDelimiter{\abs}{\lvert}{\rvert}
   \norm
265 \DeclarePairedDelimiter{\norm}{\lVert}{\rVert}
 \supnorm
266 \newcommand{\@supnormstar}[1]{\norm*{#1}_\infty}
267 \newcommand{\@supnormnostar}[2][]{\norm[#1]{#2}_\infty}
268 \newcommand{\supnorm}{\@ifstar\@supnormstar\@supnormnostar}
 \expands
269 \newcommand{\expands}[1][2.5]{\mathrel{\scalebox{#1}[1.1]{$\sim$}}}
```

3.5.2 Pseudodifferential Operators

```
          \std
270 \newcommand{\std}{{\scriptscriptstyle{\ch@irxscriptfont{std}}}}
         \Weyl
271 \newcommand{\Weyl}{{\scriptscriptstyle{\ch@irxscriptfont{Weyl}}}}
           \Op
272 \newcommand{\Op}{\operatorname{Op}}
        \Opstd
273 \newcommand{\Opstd}{\operatorname{Op}_\std}
       \OpWeyl
274 \newcommand{\OpWeyl}{\operatorname{Op}_\Weyl}
```

3.5.3 Function Spaces

```
      \spacename
275 \newcommand{\spacename}[1]{\ch@irxspacefont{#1}}
        \Bounded
276 \newcommand{\Bounded}{\ch@irxspacefont{B}}
     \Continuous
277 \newcommand{\Continuous}{\ch@irxspacefont{C}}
      \Contbound
278 \newcommand{\Contbound}{\Continuous_{\mathrm{b}}}
           \Fun
279 \newcommand{\Fun}[1][k]{\ch@irxspacefont{C}^{#1}}
        \Cinfty
280 \newcommand{\Cinfty}{\Fun[\infty]}
        \Comega
281 \newcommand{\Comega}{\Fun[\omega]}
    \Holomorphic
282 \newcommand{\Holomorphic}{\ch@irxspacefont{O}}
\AntiHolomorphic
283 \newcommand{\AntiHolomorphic}{\cc{\Holomorphic}}
       \Schwartz
284 \newcommand{\Schwartz}{\ch@irxspacefont{S}}
        \Riemann
285 \newcommand{\Riemann}{\ch@irxspacefont{R}}
```

3.5.4 Locally Convex Spaces

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

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

\ord
```
\newcommand{\ord}{\operatorname{ord}}
```

\conv
```
\newcommand{\conv}{\operatorname{conv}}
```

\extreme
```
\newcommand{\extreme}{\operatorname{extreme}}
```

3.5.5 Hilbert Spaces

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

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

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

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

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

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

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

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

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

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

```
\specrad
          301 \newcommand{\specrad}{\operatorname{\varrho}}
  \slim
          302 \newcommand{\slim}{\operatorname*{\ch@irxoperatorfont{s-lim}}}
  \wlim
          303 \newcommand{\wlim}{\operatorname*{\ch@irxoperatorfont{w-lim}}}
```

3.5.6 Dirac's bra and ket

```
   \bra
   \ket   304 \DeclarePairedDelimiter{\ketbr@}{\vert}{\vert}
 \braket  305 \DeclarePairedDelimiter{\ket}{\vert}{\rangle}
 \ketbra  306 \DeclarePairedDelimiter{\bra}{\langle}{\vert}
          307 \newcommand{\braket}[3][]{\SP[#1]{#2 \,#1\vert\, #3}}
          308 \newcommand{\ketbra}[3][]{\ketbr@[#1]{#2 #1\rangle #1\langle #3}}
```

3.5.7 Operator Algebras

```
  \Spec
          309 \newcommand{\Spec}{\operatorname{\ch@irxoperatorfont{Spec}}}
   \Rad
          310 \newcommand{\Rad}{\operatorname{\ch@irxoperatorfont{Rad}}}
   \ind
          311 \newcommand{\ind}{\operatorname{\ch@irxoperatorfont{ind}}}
```

3.5.8 Measure Theory and Integration

```
\Measurable
          312 \newcommand{\Measurable}{\ch@irxspacefont{M}}
  \Meas
          313 \newcommand{\Meas}{\ch@irxoperatorfont{Meas}}
\BoundMeas
          314 \newcommand{\BoundMeas}{\ch@irxspacefont{BM}}
    \Lp
          315 \newcommand{\Lp}[1][{p}]{\mathrm{L}^{#1}}
  \Lone
          316 \newcommand{\Lone}{\Lp[1]}
  \Ltwo
          317 \newcommand{\Ltwo}{\Lp[2]}
```

```
\Linfty
318 \newcommand{\Linfty}{\Lp[\infty]}
\Intp
319 \newcommand{\Intp}[1][{p}]{\ch@irxspacefont{L}^{#1}}
\Intone
320 \newcommand{\Intone}{\Intp[1]}
\Inttwo
321 \newcommand{\Inttwo}{\Intp[2]}
\Intinfty
322 \newcommand{\Intinfty}{\Intp[\infty]}
\essrange
323 \newcommand{\essrange}{\operatorname{\ch@irxoperatorfont{ess\,range}}}
\esssup
324 \newcommand*{\esssup}{\operatorname*{\ch@irxoperatorfont{ess}\,\ch@irxoperatorfont{\sup}}}
\esssupnormstar
325 \newcommand{\@esssupnormstar}[1]{\norm*{#1}_{\esssup}}
326 \newcommand{\@esssupnormnostar}[2][]{\norm[#1]{#2}_{\esssup}}
327 \newcommand{\esssupnorm}{\@ifstar\@esssupnormstar\@esssupnormnostar}
\ac
328 \newcommand{\ac}{\ch@irxscriptfont{ac}}
\sing
329 \newcommand{\sing}{\ch@irxscriptfont{sing}}
```

3.5.9 Limits

```
\indlim
330 \newcommand{\indlim}{\operatorname*{{ind\,lim}}}
\projlim
331 \renewcommand{\projlim}{\operatorname*{{proj\,lim}}}
332 \fi
```

3.6 Category Theory

First we check of macros should be included:

```
333 \if@loadmath
```

3.6.1 General Category Theory

General stuff for categories.

\category
```
334 \newcommand{\category}[1]{\ch@irxcategoryfont{#1}}
```
\categoryname
```
335 \newcommand{\categoryname}[1]{\ch@irxcategorynamefont{#1}}
```
\functor
```
336 \newcommand{\functor}[1]{\ch@irxfunctorfont{#1}}
```
\groupoid
```
337 \newcommand{\groupoid}[1]{\ch@irxgroupoidfont{#1}}
```
\source
```
338 \newcommand{\source}{\ch@irxoperatorfont{source}}
```
\target
```
339 \newcommand{\target}{\ch@irxoperatorfont{target}}
```
\unit
```
340 \newcommand{\unit}{\ch@irxoperatorfont{unit}}
```
\opp
```
341 \newcommand{\opp}{\ch@irxscriptfont{opp}}
```
\asso
```
342 \newcommand{\asso}{\ch@irxoperatorfont{asso}}
```
\Hom
```
343 \newcommand{\Hom}{\operatorname{\ch@irxoperatorfont{Hom}}}
```
\End
```
344 \newcommand{\End}{\operatorname{\ch@irxoperatorfont{End}}}
```
\Aut
```
345 \newcommand{\Aut}{\operatorname{\ch@irxoperatorfont{Aut}}}
346 \WithSuffix\newcommand\Aut*{\decorate[^*]{\textrm{-}\Aut}{}}
```
\Iso
```
347 \newcommand{\Iso}{\operatorname{\ch@irxoperatorfont{Iso}}}
348 \WithSuffix\newcommand\Iso*{\decorate[^*]{\textrm{-}\Iso}{}}
```
\Obj
```
349 \newcommand{\Obj}{\operatorname{\ch@irxoperatorfont{Obj}}}
```
\Morph
```
350 \newcommand{\Morph}{\operatorname{\ch@irxoperatorfont{Morph}}}
```

3.6.2 Colimits

\colim

```
\newcommand{\colim}{\operatorname*{{colim}}}
```

```
\fi
```

3.7 Differential Geometry

First we check of macros should be included:

```
\if@loadmath
```

3.7.1 General Differential Geometry

\Lie

```
\newcommand{\Lie}{\mathscr{L}}
```

A generic bracket as paired delimiter, used in several other macros

\ch@irxbbracket

```
\DeclarePairedDelimiter{\ch@irxbracket}{[}{]}
```

A generic double bracket as paired delimiter, used in several other macros

\ch@irxbbracket

```
\DeclareMathDelimiter\ch@irxllbbracket{\mathopen}{stmry}{"4A}{stmry}{"71}
\DeclareMathDelimiter\ch@irxrrbbracket{\mathclose}{stmry}{"4B}{stmry}{"79}
\DeclarePairedDelimiter{\ch@irxbbracket}{\ch@irxllbbracket}{\ch@irxrrbbracket}
```

\Schouten

```
\newcommand{\@schoutenstar}[1]{\ch@irxbbracket*{#1}_{\scriptscriptstyle\ch@irxscriptfont{S}}}
\newcommand{\@schoutennostar}[2][]{\ch@irxbbracket[#1]{#2}_{\scriptscriptstyle\ch@irxscriptfont
\newcommand{\Schouten}{\@ifstar\@schoutenstar\@schoutennostar}
```

\Forms

```
\newcommand{\Forms}{\Omega}
```

\ZdR

```
\newcommand{\ZdR}{\ch@irxoperatorfont{Z}_{\scriptscriptstyle\mathrm{dR}}}
```

\BdR

```
\newcommand{\BdR}{\ch@irxoperatorfont{B}_{\scriptscriptstyle\ch@irxscriptfont{dR}}}
```

\HdR

```
\newcommand{\HdR}{\ch@irxoperatorfont{H}_{\scriptscriptstyle\ch@irxscriptfont{dR}}}
```

\Diffeo

```
\newcommand{\Diffeo}{\operatorname{\ch@irxoperatorfont{Diffeo}}}
```

```
   \Diffop
367 \newcommand{\Diffop}{\operatorname{\ch@irxoperatorfont{DiffOp}}}
      \loc
368 \newcommand{\loc}{\ch@irxscriptfont{loc}}
     \germ
369 \newcommand{\germ}{\operatorname{\ch@irxoperatorfont{germ}}}
     \prol
370 \newcommand{\prol}{\ch@irxoperatorfont{prol}}
\NRbracket
371 \newcommand{\@nrbracketstar}[1]{\ch@irxbracket*{#1}_{\scriptscriptstyle\ch@irxscriptfont{NR}}}
372 \newcommand{\@nrbracketnostar}[2][]{\ch@irxbracket[#1]{#2}_{\scriptscriptstyle\ch@irxscriptfont
373 \newcommand{\NRbracket}{\@ifstar\@nrbracketstar\@nrbracketnostar}
\FNbracket
374 \newcommand{\@fnbracketstar}[1]{\ch@irxbracket*{#1}_{\scriptscriptstyle\ch@irxscriptfont{FN}}}
375 \newcommand{\@fnbracketnostar}[2][]{\ch@irxbracket[#1]{#2}_{\scriptscriptstyle\ch@irxscriptfont
376 \newcommand{\FNbracket}{\@ifstar\@fnbracketstar\@fnbracketnostar}
 \Manifold
377 \newcommand{\Manifolds}{\categoryname{\categoryname{Manifold}}}
```

3.7.2 Lie Groups and Principal Fiber Bundles

```
 \lefttriv
378 \newcommand{\lefttriv}{\ch@irxoperatorfont{left}}
\righttriv
379 \newcommand{\righttriv}{\ch@irxoperatorfont{right}}
      \Gau
380 \newcommand{\Gau}{\operatorname{\ch@irxoperatorfont{Gau}}}
     \Conn
381 \newcommand{\Conn}{\operatorname{\ch@irxoperatorfont{Conn}}}
    \ratio
382 \newcommand{\ratio}{\ch@irxoperatorfont{r}}
 \Parallel
383 \newcommand{\Parallel}{\operatorname{\ch@irxoperatorfont{P}}}
       \CE
384 \newcommand{\CE}{{\scriptscriptstyle{\ch@irxscriptfont{CE}}}}
```

```
      \HCE
385 \newcommand{\HCE}{\ch@irxoperatorfont{H}_\CE}
     \fund
386 \newcommand{\fund}{\ch@irxoperatorfont{fund}}
 \Universal
387 \newcommand{\Universal}{\operatorname{\ch@irxoperatorfont{U}}}
      \BCH
388 \newcommand{\BCH}{\ch@irxscriptfont{\scriptscriptstyle{BCH}}}
 \LieGroups
389 \newcommand{\LieGroups}{\categoryname{\categoryname{LieGroup}}}
 \Principal
390 \newcommand{\Principal}{\categoryname{\categoryname{Principal}}}
\GPrincipal
391 \newcommand{\GPrincipal}[1][G]{#1\categoryname{\textrm{-}\categoryname{Principal}}}
     \Fiber
392 \newcommand{\Fiber}{\categoryname{Fiber}}
    \FFiber
393 \newcommand{\FFiber}[1][F]{#1\categoryname{\textrm{-}\categoryname{Fiber}}}
       \Pin
394 \newcommand{\Pin}{\group{Pin}}
      \Spin
395 \newcommand{\Spin}{\group{Spin}}
```

3.7.3 (Pseudo) Riemannian Geometry

```
   \nablaLC
396 \newcommand{\nablaLC}{\nabla^{\scriptscriptstyle\ch@irxscriptfont{LC}}}
   \Laplace
397 \newcommand{\Laplace}{\Delta}
 \dAlembert
398 \DeclareMathSymbol\dAlembert{\mathord}{AMSa}{"03}
   \feynman
399 \newcommand{\feynman}[1]{\ooalign{$#1$\cr\hidewidth$\raise0.19ex\hbox{/}$\hidewidth\cr}}
```

```
    \Dirac
400 \newcommand{\Dirac}{\feynman{D}}
  \rotation
401 \newcommand{\rotation}{\operatorname{\ch@irxoperatorfont{rot}}}
     \curl
402 \newcommand{\curl}{\operatorname{\ch@irxoperatorfont{curl}}}
\divergence
403 \newcommand{\divergence}{\operatorname{\ch@irxoperatorfont{div}}}
  \gradient
404 \newcommand{\gradient}{\operatorname{\ch@irxoperatorfont{grad}}}
      \Tor
405 \newcommand{\Tor}{\operatorname{\ch@irxoperatorfont{Tor}}}
      \Ric
406 \newcommand{\Ric}{\operatorname{\ch@irxoperatorfont{Ric}}}
     \scal
407 \newcommand{\scal}{\operatorname{\ch@irxoperatorfont{scal}}}
     \Riem
408 \newcommand{\Riem}{\operatorname{\ch@irxoperatorfont{Riem}}}
   \Hessian
409 \newcommand{\Hessian}{\ch@irxoperatorfont{Hessian}}
    \hodge
410 \newcommand{\hodge}{\operatorname{\star}}
```

3.7.4 Complex Geometry

```
 \Nijenhuis
411 \newcommand{\Nijenhuis}{\operatorname{\ch@irxoperatorfont{Nij}}}
      \del
412 \newcommand{\del}{\mathop{}\!\partial}
   \delbar
413 \newcommand{\delbar}{\mathop{}\!\cc{\partial}}
       \FS
414 \newcommand{\FS}{{\scriptscriptstyle{\ch@irxscriptfont{FS}}}}
```

3.7.5 Vector Bundles

```
\Lift
```
```
415 \newcommand{\Lift}{{\scriptscriptstyle{\ch@irxscriptfont{Lift}}}}
```
```
\ver
```
```
416 \newcommand{\ver}{\ch@irxscriptfont{ver}}
```
```
\hor
```
```
417 \newcommand{\hor}{\ch@irxscriptfont{hor}}
```
```
\Ver
```
```
418 \newcommand{\Ver}{\operatorname{\ch@irxoperatorfont{Ver}}}
```
```
\Hor
```
```
419 \newcommand{\Hor}{\operatorname{\ch@irxoperatorfont{Hor}}}
```
```
\Sec
```
```
420 \newcommand{\Sec}[1][k]{\Gamma^{#1}}
```
```
\Secinfty
```
```
421 \newcommand{\Secinfty}{\Sec[\infty]}
```
```
\HolSec
```
```
422 \newcommand{\HolSec}{\Sec[]_{\ch@irxscriptfont{hol}}}
```
```
\SymD
```
```
423 \newcommand{\SymD}{\mathop{}\!\ch@irxoperatorfont{D}}
```
```
\Densities
```
```
424 \newcommand{\Densities}[1][n]{\abs{\Lambda^{#1}}}
```
```
\MeasurableSections
```
```
425 \newcommand{\MeasurableSections}{\ch@irxspacefont{M}\Sec[]}
```
```
\IntpSections
```
```
426 \newcommand{\IntpSections}[1][p]{\Intp[#1]\Sec[]}
```
```
\IntegrableSections
```
```
427 \newcommand{\IntegrableSections}{\IntpSections[1]}
```
```
\Translation
```
```
428 \newcommand{\Translation}{\ch@irxoperatorfont{T}}
```
```
\frames
```
```
429 \newcommand{\frames}[1]{\ch@irxoperatorfont{#1}}
```
```
\Frames
```
```
430 \newcommand{\Frames}{\operatorname{\ch@irxoperatorfont{Frames}}}
```
```
\FDiff
```
```
431 \newcommand{\FDiff}{\ch@irxoperatorfont{F}}
```

3.7.6 Symplectic and Poisson Geometry

```
      \Sympl
 432 \newcommand{\Sympl}{\operatorname{\ch@irxgroupfont{Sympl}}}
 \Jacobiator
 433 \newcommand{\Jacobiator}[1][\pi]{\operatorname{\ch@irxoperatorfont{Jac}}_{#1}}
        \red
 434 \newcommand{\red}{\ch@irxscriptfont{red}}
       \Hess
 435 \newcommand{\Hess}{\ch@irxoperatorfont{Hess}}
        \KKS
 436 \newcommand{\KKS}{{\scriptscriptstyle\ch@irxscriptfont{KKS}}}
    \Courant
 437 \newcommand{\@courantstar}[1]{\ch@irxbbracket*{#1}_{\scriptscriptstyle\ch@irxscriptfont{C}}}
 438 \newcommand{\@courantnostar}[2][]{\ch@irxbbracket[#1]{#2}_{\scriptscriptstyle\ch@irxscriptfont{
 439 \newcommand{\Courant}{\@ifstar\@courantstar\@courantnostar}
    \Dorfman
 440 \newcommand{\@dorfmanstar}[1]{\ch@irxbbracket*{#1}_{\scriptscriptstyle\ch@irxscriptfont{D}}}
 441 \newcommand{\@dorfmannostar}[2][]{\ch@irxbbracket[#1]{#2}_{\scriptscriptstyle\ch@irxscriptfont{
 442 \newcommand{\Dorfman}{\@ifstar\@dorfmanstar\@dorfmannostar}
       \Dir
 443 \newcommand{\Dir}{\operatorname{\ch@irxoperatorfont{Dir}}}
    \Forward
 444 \newcommand{\Forward}{\mathcal{F}}
   \Backward
 445 \newcommand{\Backward}{\mathcal{B}}
    \Tangent
 446 \newcommand{\Tangent}{\mathbb{T}}
\MWreduction
 447 \newcommand{\MWreduction}{\big/\!\!\big/}
       \Mon
 448 \newcommand{\Mon}{\ch@irxoperatorfont{Mon}}
       \Hol
 449 \newcommand{\Hol}{\ch@irxoperatorfont{Hol}}
 450 \fi
```

3.8 Linear Algebra

First we check of macros should be included:

```
\if@loadmath
```

3.8.1 General Linear Algebra

```
\tr
\newcommand{\tr}{\operatorname{\ch@irxoperatorfont{tr}}}
\rank
\newcommand{\rank}{\operatorname{\ch@irxoperatorfont{rank}}}
\codim
\newcommand{\codim}{\operatorname{\ch@irxoperatorfont{codim}}}
\diag
\newcommand{\diag}{\operatorname{\ch@irxoperatorfont{diag}}}
\Trans
\newcommand{\Trans}{{\ch@irxscriptfont{\scriptscriptstyle{T}}}}
\Mat
\newcommand{\Mat}{\ch@irxoperatorfont{M}}
\SymMat
\newcommand{\SymMat}{\ch@irxoperatorfont{SymMat}}
\ann
\newcommand{\ann}{\ch@irxscriptfont{ann}}
\Span
\newcommand{\Span}[1][]{\operatorname{\ch@irxoperatorfont{span}_{#1}}}
\basis
\newcommand{\basis}[1]{\ch@irxbasisfont{#1}}
```

3.8.2 Tensors

```
\tensor
\renewcommand{\tensor}[1][{}]{\mathbin{\otimes_{\scriptscriptstyle{#1}}}}
\Tensor
\newcommand{\Tensor}{\ch@irxoperatorfont{T}}
\Anti
\newcommand{\Anti}{\Lambda}
```

```
          \Sym
                465 \newcommand{\Sym}{\ch@irxoperatorfont{S}}
    \Symmetrizer
                466 \newcommand{\Symmetrizer}{\operatorname{\ch@irxoperatorfont{Sym}}}
\AntiSymmetrizer
                467 \newcommand{\AntiSymmetrizer}{\operatorname{\ch@irxoperatorfont{Alt}}}
           \ins
                468 \newcommand{\ins}{\operatorname{\ch@irxoperatorfont{i}}}
           \jns
                469 \newcommand{\jns}{\operatorname{\ch@irxoperatorfont{j}}}
          \insa
                470 \newcommand{\insa}{\ins_{\ch@irxscriptfont{a}}}
          \inss
                471 \newcommand{\inss}{\ins_{\ch@irxscriptfont{s}}}
          \degs
                472 \newcommand{\degs}{\ch@irxoperatorfont{deg}_{\ch@irxscriptfont{s}}}
          \dega
                473 \newcommand{\dega}{\ch@irxoperatorfont{deg}_{\ch@irxscriptfont{a}}}
```

3.8.3 Inner Products

```
            \SP
                474 \DeclarePairedDelimiter{\SP} {\langle}{\rangle}
     \littlepara
                475 \newcommand{\littlepara}{{\scriptscriptstyle\parallel}}
            \IP
                476 \newcommand{\IP}[6][{}]{\decorate*[^{#2}_{#3}]{\SP[#1]{#4}}{^{#5}_{#6}}}
                477 \fi
```

3.9 Statistics

First we check of macros should be included:

```
                478 \if@loadmath
```

3.9.1 General Statistics

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

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

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

\Cor
```
\newcommand{\Cor}{\operatorname{\ch@irxoperatorfont{Cor}}}
```

```
\fi
```

3.10 Topology

First we check of macros should be included:

```
\if@loadmath
```

3.10.1 General Topology

\cl
```
\newcommand{\cl}{\ch@irxscriptfont{cl}}
```

\scl
```
\newcommand{\scl}{\ch@irxscriptfont{scl}}
```

\interior
```
\newcommand{\interior}{\circ}
```

\boundary
```
\newcommand{\boundary}{\partial}
```

\supp
```
\newcommand{\supp}{\operatorname{\ch@irxoperatorfont{supp}}}
```

\dist
```
\newcommand{\dist}{\operatorname{\ch@irxoperatorfont{dist}}}
```

\topology
```
\newcommand{\topology}[1]{\ch@irxtopologyfont{#1}}
```

\filter
```
\newcommand{\filter}[1]{\ch@irxfilterfont{#1}}
```

```
      \sheaf
493 \newcommand{\sheaf}[1]{\ch@irxsheaffont{#1}}
   \Sections
494 \newcommand{\Sections}{\operatorname{\ch@irxoperatorfont{Sections}}}
      \HOM
495 \newcommand{\HOM}{\operatorname{\ch@irxsheaffont{H}\!\mathit{om}}}
      \etale
496 \DeclarePairedDelimiter{\etale}{\lvert}{\rvert}
```

3.10.2 Categories from Topology

```
\topological
497 \newcommand{\topological}{\categoryname{top}}
\Topological
498 \newcommand{\Topological}{\categoryname{Top}}
    \Sheaves
499 \newcommand{\Sheaves}{\categoryname{Sheaves}}
 \PreSheaves
500 \newcommand{\PreSheaves}{\categoryname{PreSheaves}}
      \Etale
501 \newcommand{\Etale}{\categoryname{Etale}}
502 \fi
```