

The `amsopn` package

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1 Introduction

The `amsopn` package provides a command `\DeclareMathOperator` for defining new ‘math operator names’ similar to the standard function names `\sin`, `\lim`, `\max`, etc.

Standard file identification.

```
1 \NeedsTeXFormat{LaTeX2e}% LaTeX 2.09 can't be used (nor non-LaTeX)
2 [1994/12/01]% LaTeX date must December 1994 or later
3 \ProvidesPackage{amsopn}[1999/12/14 v2.01 operator names]
```

What `\nolimits@` does is keep a `\limits` typed by the user from having any effect. This is used for operator names whose standard usage is never to have limits.

```
4 \def\nolimits@{\@ifnextchar\limits{\nolimits\@gobble}{\nolimits}}
```

In operator names, it is sometimes desired to have text-mode punctuation characters such as `*-/:'`. Because the body of an operator name is set in math mode, these few punctuation characters will not come out right (wrong symbol/and or wrong spacing). The purpose of `\newmcodes@` is to make them act like their normal text versions.

Where practical, we use decimal numbers to cut down main mem usage (“not needed”).

```
5 \begingroup \catcode'\-=12
6 \gdef\newmcodes@{\mathcode'\ '39\mathcode'\*42\mathcode'\.'"613A%
```

Define `\std@minus` for `\relbar` use; otherwise there are problems with arrows constructed with `relbar`.

```
7 \ifnum\mathcode'\-=45 \else
8 \mathchardef\std@minus\mathcode'\-\relax
9 \fi
10 \mathcode'\-45\mathcode'\ /47\mathcode'\: "603A\relax}
11 \endgroup
```

The command `\operatorname` prints its argument as a ‘math operator’ like `\sin` or `\det`, with proper font and spacing.

```
12 \DeclareRobustCommand{\operatorname}{%
13 \ifstar{\qopname\newmcodes@ m}%
14 {\qopname\newmcodes@ o}}%
```

In the interior of the `\mathop` we need a null object (we choose a zero kern for minimum waste of main mem) in order to guard against the case where `#3` is a single letter; `TEX` will seize it and center it on the math axis if there is nothing else inside the `\mathop` atom.

```
15 \DeclareRobustCommand{\qopname}[3]{%
16 \mathop{#1\kern\z@\operatorname@font#3}%
17 \csname n#2limits@\endcsname}
```

`\DeclareMathOperator` The command `\DeclareMathOperator` defines the first argument to be an operator name whose text is the second argument. The star form means that the operator name should take limits (like `\max` or `\lim`).

```
18 \newcommand{\DeclareMathOperator}{%
19   \ifstar{\@declmathop m}{\@declmathop o}}
```

In the basic set of operator names (below) we did not use `\DeclareRobustCommand` because of the hash table cost. But we use it here to minimize the chances of trouble, since we are producing a user-defined command.

```
20 \long\def\@declmathop#1#2#3{%
21   \ifdefinable{#2}{%
22     \DeclareRobustCommand{#2}{\qopname\newmcodes@#1{#3}}}%
23 %
24 \@onlypreamble\DeclareMathOperator
25 \@onlypreamble\@declmathop
26 \def\arccos{\qopname\relax o{arccos}}
27 \def\arcsin{\qopname\relax o{arcsin}}
28 \def\arctan{\qopname\relax o{arctan}}
29 \def\arg{\qopname\relax o{arg}}
30 \def\cos{\qopname\relax o{cos}}
31 \def\cosh{\qopname\relax o{cosh}}
32 \def\cot{\qopname\relax o{cot}}
33 \def\coth{\qopname\relax o{coth}}
34 \def\csc{\qopname\relax o{csc}}
35 \def\deg{\qopname\relax o{deg}}
36 \def\det{\qopname\relax m{det}}
37 \def\dim{\qopname\relax o{dim}}
38 \def\exp{\qopname\relax o{exp}}
39 \def\gcd{\qopname\relax m{gcd}}
40 \def\hom{\qopname\relax o{hom}}
41 \def\inf{\qopname\relax m{inf}}
42 \def\injlim{\qopname\relax m{inj},\lim}}
43 \def\ker{\qopname\relax o{ker}}
44 \def\lg{\qopname\relax o{lg}}
45 \def\lim{\qopname\relax m{lim}}
46 \def\liminf{\qopname\relax m{lim},\inf}}
47 \def\limsup{\qopname\relax m{lim},\sup}}
48 \def\ln{\qopname\relax o{ln}}
49 \def\log{\qopname\relax o{log}}
50 \def\max{\qopname\relax m{max}}
51 \def\min{\qopname\relax m{min}}
52 \def\Pr{\qopname\relax m{Pr}}
53 \def\projlim{\qopname\relax m{proj},\lim}}
54 \def\sec{\qopname\relax o{sec}}
55 \def\sin{\qopname\relax o{sin}}
56 \def\sinh{\qopname\relax o{sinh}}
57 \def\sup{\qopname\relax m{sup}}
58 \def\tan{\qopname\relax o{tan}}
59 \def\tanh{\qopname\relax o{tanh}}
```

`\operator@font` This command is provided to allow the document styles to decide in which way math operators like ‘max’ or ‘log’ are typeset. The default is to set them in $\langle\mathit{group}\rangle$ zero of the current math version. The original name was `\operator@font`, retained for compatibility; the second name was added to make it more accessible so that users can call this font for use in special constructs that are not ordinary operator names but conceptually related.

```
60 \def\operator@font{\mathgroup\symoperators}
61 \def\operatorfont{\operator@font}
```

For backwards compatibility we keep this old command name for the time being:

```
62 \def\operatornamewithlimits{\operatorname*}
```

These macros use `\mathpalettes` so that they will change size in script and scriptscript styles, though it's hard to imagine they will ever be used there (the arrows, particularly, look bad in subscript sizes). Notice that the use of `\ex@` means that the vertical spacing may not be optimal in script and scriptscript sizes. Unfortunately T_EX provides no easy way to do math mode vertical spacing that varies with current math style like mu units.

```
63 \def\varlim@#1#2{%
64   \vtop{\m@th\ialign{##\cr
65     \hfil$#1\operator@font lim$\hfil\cr
66     \noalign{\nointerlineskip\kern1.5\ex@}\#2\cr
67     \noalign{\nointerlineskip\kern-\ex@}\cr}}%
68 }
69 \def\varinjlim{%
70   \mathop{\mathpalette\varlim@\{\rightarrowfill@\textstyle\}}\nmlimits@
71 }
72 \def\varprojlim{%
73   \mathop{\mathpalette\varlim@\{\leftarrowfill@\textstyle\}}\nmlimits@
74 }
75 \def\varliminf{\mathop{\mathpalette\varliminf@{}}\nmlimits@}
76 \def\varliminf@#1{\@@underline{\vrule\@depth.2\ex@\@width\z@
77   \hbox{$#1\m@th\operator@font lim$}}}%
78 \def\varlimsup{\mathop{\mathpalette\varlimsup@{}}\nmlimits@}
79 \def\varlimsup@#1{\@@overline{\hbox{$#1\m@th\operator@font lim$}}}%
80 \let\nmlimits@\displaylimits
81 \DeclareOption{namelimits}{\let\nmlimits@\displaylimits}
82 \DeclareOption{nonamelimits}{\let\nmlimits@\nolimits}
83 \ProcessOptions\relax
```

If we don't load the `amsgen` package then the use of `\ex@` in `\varlim@` will lead to trouble.

```
84 \RequirePackage{amsgen}\relax
```

The usual `\endinput` to ensure that random garbage at the end of the file doesn't get copied by `docstrip`.

```
85 \endinput
```

Index

Numbers written in *italic* refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; numbers in roman refer to the code lines where the entry is used.

Symbols			
<code>\</code>	..... 5	<code>\onlypreamble</code>	. 24, 25
<code>\'</code>	..... 6	A	
<code>\*</code>	..... 6	<code>amsgen</code> package	..... 3
<code>\,</code>	..... 42, 46, 47, 53	<code>AMSOPN</code> package	..... 2
<code>\-</code>	..... 7, 8, 10	<code>amsopn</code> package	..... 1, 1
<code>\.</code>	..... 6	<code>\arccos</code>	..... 26
<code>\:</code>	..... 10	<code>\arcsin</code>	..... 27
<code>\@@overline</code>	..... 79	<code>\arctan</code>	..... 28
<code>\@@underline</code>	..... 76	<code>\arg</code>	..... 29
<code>\@declmathop</code>	19, 20, 25	C	
<code>\@ifdefinable</code>	..... 21	<code>\cos</code>	..... 30
		<code>\cosh</code>	..... 31
		<code>\cot</code>	..... 32
		<code>\coth</code>	..... 33
		<code>\cr</code>	..... 64, 65, 66, 67
		<code>\csc</code>	..... 34
		D	
		<code>\DeclareMathOperator</code>	..... 1, 2, 18, 24
		<code>\DeclareOption</code>	. 81, 82
		<code>\DeclareRobustCommand</code>	..... 2, 12, 15, 22

- \backslash deg 35
 \backslash det 1, 36
 \backslash dim 37
 \backslash displaylimits . 80, 81
docstrip 3
- E**
- \backslash endinput 3
 \backslash ex@ 3, 3, 66, 67, 76
 \backslash exp 38
- G**
- \backslash gcd 39
- H**
- \backslash hbox 77, 79
 \backslash hfil 65
 \backslash hom 40
- I**
- \backslash ialign 64
 \backslash inf 41
 \backslash injl原因 42
- K**
- \backslash ker 43
 \backslash kern 16, 66, 67
- L**
- \backslash leftarrowfill@ ... 73
 \backslash lg 44
 \backslash lim 1, 2, 45
 \backslash liminf 46
 \backslash limits 1, 4
 \backslash limsup 47
 \backslash ln 48
 \backslash log 49
- M**
- \backslash m@th 64, 77, 79
 \backslash mathchardef 8
 \backslash mathcode .. 6, 7, 8, 10
 \backslash mathgroup 60
 \backslash mathop 1, 1,
16, 70, 73, 75, 78
 \backslash mathpalette
. 3, 70, 73, 75, 78
 \backslash max 1, 2, 50
- N**
- \backslash NeedsTeXFormat 1
 \backslash newmcodes@
.. 1, 6, 13, 14, 22
 \backslash nmlimits@ . 70, 73,
75, 78, 80, 81, 82
 \backslash noalign 66, 67
 \backslash nointerlineskip 66, 67
 \backslash nolimits 4, 82
 \backslash nolimits@ 1, 4
- O**
- \backslash operator@font . 2,
16, 60, 65, 77, 79
 \backslash operatorfont 60
 \backslash operatorname 1, 12, 62
 \backslash operatornamewithlimits
..... 62
- P**
- \backslash Pr 52
 \backslash ProcessOptions ... 83
 \backslash projlim 53
 \backslash ProvidesPackage ... 3
- Q**
- \backslash qopname 13,
14, 15, 22, 26,
- 27, 28, 29, 30,
31, 32, 33, 34,
35, 36, 37, 38,
39, 40, 41, 42,
43, 44, 45, 46,
47, 48, 49, 50,
51, 52, 53, 54,
55, 56, 57, 58, 59
- R**
- \backslash relbar 1
 \backslash RequirePackage ... 84
 \backslash rightarrowfill@ .. 70
- S**
- \backslash sec 54
 \backslash sin 1, 1
 \backslash sinh 56
 \backslash std@minus 1, 8
 \backslash sup 57
 \backslash symoperators 60
- T**
- \backslash tan 58
 \backslash tanh 59
 \backslash textstyle 70, 73
- V**
- \backslash varinjlim 69
 \backslash varlim@ .. 3, 63, 70, 73
 \backslash varliminf 75
 \backslash varliminf@ 75, 76
 \backslash varlimsup 78
 \backslash varlimsup@ 78, 79
 \backslash varprojlim 72
 \backslash vtop 64