The \texttt{xfp} package
Floating Point Unit

The \LaTeX{} Project$^*$
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The two functions provided by this package are part of the \LaTeX{} format starting with 2022-06-01 release. This package is therefore no longer needed and only provided to be able to process older documents loading.

This package provides a \LaTeX{} document-level interface to the \LaTeX{} floating point unit (part of expl3). It also provides a parallel integer expression interface for convenience.

\begin{verbatim}
\fpeval \* The expandable command \texttt{\fpeval} takes as its argument a floating point expression and produces a result using the normal rules of mathematics. As this command is expandable it can be used where \TeX{} requires a number and for example within a low-level \texttt{\edef} operation to give a purely numerical result.

Briefly, the floating point expressions may comprise:

- Basic arithmetic: addition $x + y$, subtraction $x - y$, multiplication $x \times y$, division $x/y$, square root $\sqrt{x}$, and parentheses.
- Comparison operators: $x < y$, $x \leq y$, $x > y$, $x \neq y$ etc.
- Boolean logic: sign $x$, negation $\neg x$, conjunction $x \& y$, disjunction $x \mid y$, ternary operator $x ? y : z$.
- Exponentials: $\exp x$, $\ln x$, $x^y$.
- Integer factorial: $\text{fact} x$.
- Trigonometry: $\sin x$, $\cos x$, $\tan x$, $\cot x$, $\sec x$, $\csc x$ expecting their arguments in radians, and sind $x$, cosd $x$, tand $x$, cotd $x$, secd $x$, csed $x$ expecting their arguments in degrees.
- Inverse trigonometric functions: $\arcsin x$, $\arccos x$, $\arctan x$, $\arccot x$, $\arcsec x$, $\arccsc x$ giving a result in radians, and asind $x$, acosd $x$, atand $x$, cotd $x$, secd $x$, csed $x$ giving a result in degrees.
- Extrema: $\max(x_1, x_2, \ldots)$, $\min(x_1, x_2, \ldots)$, $\abs(x)$.
- Rounding functions, controlled by two optional values, $n$ (number of places, 0 by default) and $t$ (behavior on a tie, NaN by default):
\end{verbatim}

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− \texttt{trunc}(x,n) \text{ rounds towards zero,}
− \texttt{floor}(x,n) \text{ rounds towards } -\infty,
− \texttt{ceil}(x,n) \text{ rounds towards } +\infty,
− \texttt{round}(x,n,t) \text{ rounds to the closest value, with ties rounded to an even value}
\text{ by default, towards zero if } t = 0, \text{ towards } +\infty \text{ if } t > 0 \text{ and towards } -\infty \text{ if } t < 0.

• Random numbers: \texttt{rand()}, \texttt{randint}(m,n).
• Constants: \texttt{pi}, \texttt{deg} (one degree in radians).
• Dimensions, automatically expressed in points, \textit{e.g.}, \texttt{pc} is 12.
• Automatic conversion (no need for \texttt{number}) of integer, dimension, and skip variables to floating points numbers, expressing dimensions in points and ignoring the stretch and shrink components of skips.
• Tuples: \((x_1, \ldots, x_n)\) that can be added together, multiplied or divided by a floating point number, and nested.

An example of use could be the following.

\LaTeX{} can now compute: $\frac{\sin (3.5)}{2} + 2\cdot 10^{-3} = \fpeval{\sin(3.5)/2 + 2e-3}$.

\texttt{\inteval \star} The expandable command \texttt{\inteval} takes as its argument an integer expression and produces a result using the normal rules of mathematics. The operations recognised are +, -, *, and / plus parentheses. Division occurs with \texttt{rounding}, and ties are rounded away from zero. As this command is expandable it can be used where \TeX{} requires a number and for example within a low-level \texttt{\edef} operation to give a purely numerical result.

An example of use could be the following.

\LaTeX{} can now compute: The sum of the numbers is $\inteval{1 + 2 + 3}$.

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F & N \\
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