The 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 LaTeX2ε document-level interface to the LaTeX3 floating point unit (part of expl3). It also provides a parallel integer expression interface for convenience.

\fpeval \par

The expandable command \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 \edef operation to give a purely numerical result.

Briefly, the floating point expressions may comprise:

- Basic arithmetic: addition \(x + y\), subtraction \(x - y\), multiplication \(x \ast y\), division \(x/y\), square root \(\sqrt{x}\), and parentheses.
- Comparison operators: \(x < y\), \(x \leq y\), \(x > y\), \(x! = y\) etc.
- Boolean logic: sign \(\text{sign} x\), negation \(!x\), conjunction \(x \& \& y\), disjunction \(x || y\), 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 \(\text{sign} x\), \(\cosd x\), \(\tand x\), \(\cotd x\), \(\secd x\), \(\csdd x\) expecting their arguments in degrees.
- Inverse trigonometric functions: \(\text{asin} x\), \(\text{acos} x\), \(\text{atan} x\), \(\text{acot} x\), \(\text{asec} x\), \(\text{acsc} x\) giving a result in radians, and \(\text{asind} x\), \(\text{acosd} x\), \(\atan d x\), \(\text{acotd} x\), \(\text{asecd} x\), \(\text{acscd} x\) giving a result in degrees.
- Extrema: \(\text{max}(x_1, x_2, \ldots)\), \(\text{min}(x_1, x_2, \ldots)\), \(\text{abs}(x)\).
- Rounding functions, controlled by two optional values, \(n\) (number of places, 0 by default) and \(t\) (behavior on a tie, NaN by default):

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\begin{itemize}
  \item \textbf{Random numbers:} \texttt{rand()}, \texttt{randint}(m, n).
  \item \textbf{Constants:} \texttt{pi}, \texttt{deg} (one degree in radians).
  \item \textbf{Dimensions, automatically expressed in points, e.g.,} \texttt{pc} is 12.
  \item \textbf{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.}
  \item \textbf{Tuples:} \((x_1, \ldots, x_n)\) that can be added together, multiplied or divided by a floating point number, and nested.
\end{itemize}

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 \texttt{\inteval} 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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The italic numbers denote the pages where the corresponding entry is described, numbers underlined point to the definition, all others indicate the places where it is used.

\begin{center}
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  \texttt{\inteval} & \ldots & 2 \\
  \texttt{\fpeval} & \ldots & 1 \\
  \texttt{\number} & \ldots & 2
\end{array}
\end{center}