The xfp package
Floating Point Unit
The \LaTeX\ Project*
Released 2024-02-18

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\2ε document-level interface to the \LaTeX\3 floating point unit (part of expl3). It also provides a parallel integer expression interface for convenience.

\fpeval * 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 $x * y$, division $x/y$, square root $\sqrt{x}$, and parentheses.
- Comparison operators: $x < y$, $x \leq y$, $x > y$, $x ! = y$ etc.
- Boolean logic: sign 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 $\sin\!d{x}$, $\cos\!d{x}$, $\tan\!d{x}$, $\cot\!d{x}$, $\sec\!d{x}$, $\csc\!d{x}$ expecting their arguments in degrees.
- Inverse trigonometric functions: $\arcsin{x}$, $\arccos{x}$, $\arctan{x}$, $\arccot{x}$, $\sec^{-1}{x}$, $\csc^{-1}{x}$ giving a result in radians, and $\arcsin\!d{x}$, $\arccos\!d{x}$, $\arctan\!d{x}$, $\arccot\!d{x}$, $\sec^{-1}\!d{x}$, $\csc^{-1}\!d{x}$ giving a result in degrees.
- Extrema: $\max(x_1, x_2, \ldots)$, $\min(x_1, x_2, \ldots)$, $\text{abs}(x)$.
- Rounding functions, controlled by two optional values, $n$ (number of places, 0 by default) and $t$ (behavior on a tie, \text{NaN} by default):

\footnote{E-mail: latex-team@latex-project.org}
– trunc(x, n) rounds towards zero,
– floor(x, n) rounds towards −∞,
– ceil(x, n) rounds towards +∞,
– round(x, n, t) rounds to the closest value, with ties rounded to an even value by default, towards zero if t = 0, towards +∞ if t > 0 and towards −∞ if t < 0.

• Random numbers: rand(), randint(m, n).
• Constants: pi, deg (one degree in radians).
• Dimensions, automatically expressed in points, e.g., pc is 12.
• Automatic conversion (no need for \number) of integer, dimension, and skip variables to floating point numbers, expressing dimensions in points and ignoring the stretch and shrink components of skips.
• Tuples: (x₁, . . . , xₙ) 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: $\frac{\sin (3.5)}{2} + 2\cdot 10^{-3} = \fpeval{\sin(3.5)/2 + 2e-3}$.

\interval \textbf{⋆} The expandable command \interval 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 \textit{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 \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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