

C support for IEEE 754-201x

WG 14 N2275

2018-07-05

C FP Group

C99, C11, and C17 include optional support and IEC 60559:1989 (IEEE 754-1985). TS 18661 (2014-2016), which updates this support to IEC 60559:2011 (IEEE 754-2008), is being considered for inclusion in C2x.

IEEE 754 is finishing another revision cycle, with publication expected in 201x, and with publication as an IEC standard thereafter. See <http://754r.ucbtest.org/>. This is a minor revision, for defect fixes and clarification. It is constrained to require no new features. Thus, the few features too important to defer to the subsequent revision have been added as optional.

Some of the new IEEE 754 features had already been deemed by CFP and WG 14 to be needed natural completions for its floating-point facilities, and hence are in current C or TS 18661.

CFP has drafted changes for C support for the other new 754 features. These amount to a small addition to C2x, as the list below shows, but advances C support of the floating-point standard ahead another 10 years.

Below is the IEEE 754 committee's list of substantive changes (by subclause) in the IEEE 754 revision, draft 238, together with CFP comments and status regarding C. A few minor additions should be expected to this list.

4.3.1 roundTiesToEven definition extended to cover the unusual case when both nearest neighbors are odd

This is more of a defect fix, as the old specification was not meaningful for the special case. This is covered in P1 CR 21.

5.3.1 {min,max}{Num,NumMag} operations, formerly required, are now deleted

The 754 committee took this unusual step because it believed the specification was seriously flawed and problematic for the intended use.

This, along with 754's replacement min-max operations (see below), are covered by a suggested update to P1-3 in N2273.

5.3.2 new quantum operation for decimal formats is recommended

Already in P2.

5.7.1 new predicate operation is754version2018 is required

Supported by feature macros.

5.10 totalOrder and totalOrderMag definition relaxed the ordering of NaNs
P1 does not state the detailed specification, but adopts it from IEC 60559 by reference, so will pick up the change automatically.

9.2 new aSinPi, aCosPi, and tanPi operations are recommended
Already in P4.

9.2.1 new special cases for power functions
Already in C and P4.

9.2.2 preferred exponents are specified for 9.2 operations
This is covered in P4 CR 18.

9.4 preferred exponents and inexact exception are not specified for reduction operations
Already in P4.

9.5 new augmented{Addition,Subtraction,Multiplication} are recommended
Suggested addition to P4 in N2274.

9.6 new {min,max}imum{Number,Magnitude,MagnitudeNumber} operations are recommended; NaN handling is changed from 754-2008 5.3.1.
Suggested addition to P1-3 in N2273.

9.7 new {get,set,setsignaling}payload operations are recommended
Already in P1. P1 CR needed for edge case return value.

TS 18661 is written based on IEC 60559:2011 (IEEE 754-2008) and contains many references to that version of the floating-point standard; however, few of the references appear in changes to C. C support for the newer version of the floating-point standard will entail updating the references in C.

Parts of TS 18661 not fully integrated into C will need to be updated to refer to the newer version of the floating-point standard (as well as to the newer version of C).