

Proposal for C2Y

WG14 N3896

Title: Range bounds for complex math functions

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Date: 2026-05-08

Proposal category: Technical

Reference Documents: C2Y draft N3854. Original issue: N3731

Motivation:

WG14 reflector message SC22WG14.34179 from Joseph Myers points out that the range bounds issue addressed by CFP's N3731 does not cover the same issue for complex functions. This paper addresses the issue for cacos (7.3.5.1), casin (7.3.5.2), catan (7.3.5.3), cacosh (7.3.6.1), casinh (7.3.6.2) and catanh (7.3.6.3) which we believe are all the missing functions that were not previously handled.

Note to the editor for the proposed changes: Please ensure the minus (not hyphen) sign and symbols (such as π and i) use the correct symbols as they may differ from this document due to different fonts and styles.

Proposed Changes:

Change 7.3.5.1 from:

Description

The `ccos` functions compute the **complex arc cosine of z** , with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

The `ccos` functions return the complex arc cosine **value, in the range of a strip mathematically unbounded along the imaginary axis and in the interval $[0, \pi]$ along the real axis.**

To:

Description

The `ccos` functions compute the **branch of the complex arc cosine of z whose range is the strip unbounded along the imaginary axis and in the interval $[0, \pi]$ along the real axis**, with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

The `ccos` functions return the complex arc cosine **of z** .

NOTE The `ccos` functions, and similarly the `casin`, `catan`, `ccosh`, `casinh` and `catanh` functions, can return a value outside the specified range of the computed mathematical function. If the range interval has an endpoint that is not representable as a floating-point number (such as π , in the case of `ccos`), even correct rounding can yield values outside the range interval, depending on the return type and rounding direction.

Change 7.3.5.2 from:

Description

The `casin` functions compute the **complex arc sine of z** , with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

The `casin` functions return the complex arc sine **value, in the range of a strip mathematically unbounded along the imaginary axis and in the interval $[-\frac{\pi}{2}, +\frac{\pi}{2}]$ along the real axis.**

To:

Description

The `casin` functions compute the **branch of the complex arc sine of z whose range is the strip unbounded along the imaginary axis and in the interval $[-\frac{\pi}{2}, +\frac{\pi}{2}]$ along the real axis**, with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

The `casin` functions return the complex arc sine **of z** .

Change 7.3.5.3 from:

Description

The `catan` functions compute the **complex arc tangent of z** , with branch cuts outside the interval $[-i, +i]$ along the imaginary axis.

Returns

The `catan` functions return the complex arc tangent **value, in the range of a strip mathematically unbounded along the imaginary axis and in the interval $[-\frac{\pi}{2}, +\frac{\pi}{2}]$ along the real axis.**

To:

Description

The `catan` functions compute the **branch of the complex arc tangent of z whose range is the strip unbounded along the imaginary axis and in the interval $[-\frac{\pi}{2}, +\frac{\pi}{2}]$ along the real axis**, with branch cuts outside the interval $[-i, +i]$ along the imaginary axis.

Returns

The `catan` functions return the complex arc tangent **of z .**

Change 7.3.6.1 from:

Description

The `cacosh` functions compute the **complex arc hyperbolic cosine of z** , with branch cuts at values less than 1 along the real axis.

Returns

The `cacosh` functions return the complex arc hyperbolic cosine **value, in the range of a half-strip of non-negative values along the real axis and in the interval $[-i\pi, +i\pi]$ along the imaginary axis.**

To:

Description

The `cacosh` functions compute the **branch of the complex arc hyperbolic cosine of z whose range is a half-strip of non-negative values along the real axis and in the interval $[-i\pi, +i\pi]$ along the imaginary axis**, with branch cuts at values less than 1 along the real axis.

Returns

The `cacosh` functions return the complex arc hyperbolic cosine **of z** .

Change 7.3.6.2 from:

Description

The `casinh` functions compute the **complex arc hyperbolic sine of z** , with branch cuts outside the interval $[-i, +i]$ along the imaginary axis.

Returns

The `casinh` functions return the complex arc hyperbolic sine **value, in the range of a strip mathematically unbounded along the real axis and in the interval $[-\frac{i\pi}{2}, +\frac{i\pi}{2}]$ along the imaginary axis.**

To:

Description

The `casinh` functions compute the **branch of the complex arc hyperbolic sine of z whose range is a strip mathematically unbounded along the real axis and in the interval $[-i\frac{\pi}{2}, +i\frac{\pi}{2}]$ along the imaginary axis**, with branch cuts outside the interval $[-i, +i]$ along the imaginary axis.

Returns

The `casinh` functions return the complex arc hyperbolic sine **of z .**

Change 7.3.6.3 from:

Description

The `catanh` functions compute the **complex arc hyperbolic tangent of z** , with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

The `catanh` functions return the complex arc hyperbolic tangent **value, in the range of a strip mathematically unbounded along the real axis and in the interval $[-\frac{i\pi}{2}, +\frac{i\pi}{2}]$ along the imaginary axis.**

To:

Description

The `catanh` functions compute **the branch of the complex arc hyperbolic tangent of z whose range is a strip mathematically unbounded along the real axis and in the interval $[-i\frac{\pi}{2}, +i\frac{\pi}{2}]$ along the imaginary axis**, with branch cuts outside the interval $[-1, +1]$ along the real axis.

Returns

The `catanh` functions return the complex arc hyperbolic tangent **of z** .