numbers are permitted. However, it's safe to say that the vast majority of C programs are executed on systems that support this standard.

- ***Provide more control over floating-point arithmetic.*** Better control over floating-point arithmetic may allow programs to achieve greater accuracy and speed.
- ***Make C more attractive to Fortran programmers.*** The addition of many math functions, along with enhancements elsewhere in C99 (such as support for complex numbers), was intended to increase C's appeal to programmers who might have used other programming languages (primarily Fortran) in the past.

Another reason that I've decided to cover C99's `<math.h>` header in a separate section is that it's not likely to be of much interest to the average C programmer. Those using C for its traditional applications, which include systems programming and embedded systems, probably won't need the additional functions that C99 provides. However, programmers developing engineering, mathematics, or science applications may find these functions to be quite useful.

IEEE Floating-Point Standard

One motivation for the changes to the `<math.h>` header is better support for IEEE Standard 754, the most widely used representation for floating-point numbers. The full title of the standard is "IEEE Standard for Binary Floating-Point Arithmetic" (ANSI/IEEE Standard 754-1985). It's also known as IEC 60559, which is how the C99 standard refers to it.

Section 7.2 described some of the basic properties of the IEEE standard. We saw that the standard provides two primary formats for floating-point numbers: single precision (32 bits) and double precision (64 bits). Numbers are stored in a form of scientific notation, with each number having three parts: a sign, an exponent, and a fraction. That limited knowledge of the IEEE standard is enough to use the C89 version of `<math.h>` effectively. Understanding the C99 version, however, requires knowing more about the standard. Here's some additional information that we'll need:

- ***Positive/negative zero.*** One of the bits in the IEEE representation of a floating-point number represents the number's sign. As a result, the number zero can be either positive or negative, depending on the value of this bit. The fact that zero has two representations may sometimes require us to treat it differently from other floating-point numbers.
- ***Subnormal numbers.*** When a floating-point operation is performed, the result may be too small to represent, a condition known as *underflow*. Think of what happens if you repeatedly divide a number using a hand calculator: eventually the result is zero, because it becomes too small to represent using the calculator's number representation. The IEEE standard has a way to reduce the impact of this phenomenon. Ordinary floating-point numbers are stored in a "normalized" format, in which the number is scaled so that there's exactly one