INTERVAL ARITHMETIC SUPPORT IN THE SUN FORTRAN COMPILER

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Abstract

In this talk we describe the native support for interval arithmetic, as implemented in the Sun Fortran 95 Compiler (hereafter referred to as "f95").

The f95 compiler from Sun provides full intrinsic support for interval data types. We have chosen to extend the language with the INTERVAL data type. All basic mathematical operations, plus the Fortran intrinsic functions, are defined for variables having the type INTERVAL.

This level of compiler support is not sufficient however. When dealing with intervals, additional interval-specific extensions to specific operations and intrinsics need to be defined and implemented.

One example of this is the use of logical operators. Intervals are only partially ordered mathematical objects. For example, one might have the situation that two variables of type INTERVAL partially overlap (e.g. [-1,2] and [1,3]). Therefore, to resolve any ambiguity and to make code easier to write and read, we have extended the set of logical operators to handle this kind of situation and other scenario's.

We also added a set of interval-specific intrinsic functions. To calculate the width of an interval for example.
In addition to providing this kind of extended functionality, we also introduced several quality of implementation features, including:

- A closed interval system in which all expressions (including singularities and indeterminate forms) are defined
- Domain constraints on intrinsic functions are gracefully handled
- Input/Output can be handled in different ways
- Context dependent literal interval constants are supported
- Mixed mode expressions are supported

Thanks to these features, we believe that the Sun Fortran Compiler provides a high quality, reliable and easy to use environment for the development of interval arithmetic applications.