Subject: Solving elliptic equation in IDL
Posted by Mark Hadfield on Sun, 17 Aug 2003 23:35:14 GMT
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Hi guys

I want to solve an elliptic equation on a rectangular portion of the (x,y) plane, specifically

L(A) = f(x,y)

where A is an unknown, scalar-valued 2D array, L is the Laplacian operator (d2/dx2 + d2/dy2) and the RHS (forcing) term is a function of space only. A is specified at the boundary.

This can be done with an elliptic equation solver, of the type that can be found in many general-purpose mathematical libraries. However a Google search has not uncovered any IDL code to do this. So I have two questions:

- Does anyone have or know of an IDL elliptic equation solver?

- If I choose to solve the equation in Fortran (Compaq Visual Fortran 6.6B, IMSL Fortran Library,IDL 6.0, Windows 2000), what is the path of least resistance for passing data between Fortran and IDL? A DLM? Can I call a Fortran subroutine directly from IDL or will I need to write glue code in C?

--
Mark Hadfield "Ka puwaha te tai nei, Hoea tatou"
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National Institute for Water and Atmospheric Research (NIWA)

Subject: Re: Solving elliptic equation in IDL
Posted by Mark Hadfield on Wed, 27 Aug 2003 22:17:16 GMT
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Mark Hadfield wrote:
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>
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> (x,y) plane, specifically
>
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> path of least resistance for passing data between Fortran and IDL? A
> DLM? Can I call a Fortran subroutine directly from IDL or will I
> need to write glue code in C?

Thanks for the replies. I thought I'd report progress to the group, in case it helps someone in future.

I ended up using CALL_EXTERNAL to interface with the NCAR FISHPACK Fortran library. On the IDL side I wrote a wrapper routine to check arguments before passing them to CALL_EXTERNAL. On the Fortran side I wrote a glue routine to convert the "argc, argv" data passed by CALL_EXTERNAL to the format required by the FISHPACK routines. For the latter I found the following news threads useful:

http://makeashorterlink.com/?G2E1525A5
http://makeashorterlink.com/?C273235A5

Below is an example of such a glue routine, written. It's similar to examples in the above threads, but illustrates one extra trick: using an "ATTRIBUTES VALUE" declaration on argc so this can be accessed in the Fortran code.

--
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--- testadd.f90 ---

```
function testadd(argc, argv)

  !DEC$ ATTRIBUTES DLLEXPORT :: testadd
  !DEC$ ATTRIBUTES VALUE :: argc

  integer(kind=4) :: testadd

  integer(kind=4), intent(in) :: argc
```

```
  integer(kind=4), intent(in) :: argv(argc)

  if (argc.eq.4) then
    call  add(%val(argv(1)),%val(argv(2)),%val(argv(3)),%val(argv(4)))
    testadd = 1
  else
    testadd = 0
  end if

contains

  subroutine add(a, b, c, n)

    integer(kind=4), intent(in) :: n
    real(kind=4), intent(in) :: a(n), b(n)
    real(kind=4) :: c(n)

    c = a + b

  end subroutine add

end function testadd
```

Subject: Re: Solving elliptic equation in IDL
Posted by dallimor on Thu, 28 Aug 2003 09:31:20 GMT
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Mark, I just saw this thread and thought I'd make a comment. I did a bit of interfacing between IDL and Fortran last year but I've just moved and my code is in transit so I don't have any examples with me.

We did it a little differently but the principle was the same. The comment I wanted to make was that this method removes any chance of porting code because the "ATTRIBUTES VALUE" declaration is compiler and OS specific. Also one other thing that we found was that to link IDL to Compaq fortran the machine needed to have Visual C++ installed. I never actually tracked down what libraries were required but I couldn't get it to work without VC++ installed.

Did you build a dll or a dlm?

Chris Dallimore

Mark Hadfield <m.hadfield@niwa.co.nz> wrote in message news:<bijalf$5ba$1@newsreader.mailgate.org>...
> Mark Hadfield wrote:
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>> (x,y) plane, specifically
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>>   L(A) = f(x,y)
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>> operator (d2/dx2 + d2/dy2) and the RHS (forcing) term is a function of
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> examples in the above threads, but illustrates one extra trick: using an
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>
> --
> Mark Hadfield   "Ka puwaha te tai nei, Hoea tatou"
> m.hadfield@niwa.co.nz
> National Institute for Water and Atmospheric Research (NIWA)
>
> --- testadd.f90 ---
>

```
>  function testadd(argc, argv)
>
>    !DEC$ ATTRIBUTES DLLEXPORT :: testadd
>    !DEC$ ATTRIBUTES VALUE :: argc
>
>    integer(kind=4) :: testadd
>
>    integer(kind=4), intent(in) :: argc
>    integer(kind=4), intent(in) :: argv(argc)
>
>    if (argc.eq.4) then
>       call  add(%val(argv(1)),%val(argv(2)),%val(argv(3)),%val(argv(4)))
>       testadd = 1
>    else
>       testadd = 0
>    end if
>
>  contains
>
>    subroutine add(a, b, c, n)
>
>      integer(kind=4), intent(in) :: n
>      real(kind=4), intent(in) :: a(n), b(n)
>      real(kind=4) :: c(n)
>
>      c = a + b
>
>    end subroutine add
>
>  end function testadd
```

Subject: Re: Solving elliptic equation in IDL
Posted by Mark Hadfield on Thu, 28 Aug 2003 20:12:37 GMT
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Chris Dallimore wrote:

```
>  Mark,  I just saw this thread and thought I'd make a comment.  I did a
>  bit of interfacing between IDL and Fortran last year but I've just
>  moved and my code is in transit so I don't have any examples with me.
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>  We did it a little differently but the principle was the same.  The
>  comment I wanted to make was that this method removes any chance of
>  porting code because the "ATTRIBUTES VALUE" declaration is compiler
>  and OS specific.
```

Yes. So is the the %VAL function used to dereference the elements of

argv (though I believe the %VAL function is more widely supported than
the ATTRIBUTES VALUE declaration).

If you want to make any sense of the argc argument you do need some way
to tell the Fortran routine that it has been passed by value. If that's
not possible on your compiler, then you can do without. Just declare
your argv array as "argv(*)". Make sure you don't go out of bounds and
don't expect argc to have a meaningful value.

On the other hand you definitely can't do without %VAL (or equivalent).
If your compiler doesn't support that you need to write your glue
routine in C.

The good news is that Fortran 2000 will standardise all this.

> Also one other thing that we found was that to link
> IDL to Compaq fortran the machine needed to have Visual C++ installed.
> I never actually tracked down what libraries were required but I
> couldn't get it to work without VC++ installed.

Hmmm. I don't have any problems there and I have never had VC++
installed on this machine.

> Did you build a dll or a dlm?

DLL.

--
Mark Hadfield "Ka puwaha te tai nei, Hoea tatou"
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National Institute for Water and Atmospheric Research (NIWA)