Subject: matrix log and exp
Posted by G Karas on Wed, 17 Apr 2002 19:01:56 GMT
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Hi group,
one quickie and possibly difficult:

IDL does not have a matrix logarithm logm and matrix
exponent expm function. I was thinking of calling lapack
routines which do it, but have no experience with lapack
or FORTRAN. Anyone with any tips on this one?

cheers!

Giorgos Karas, M.D.

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'Vrije Universiteit' Medical Center
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email: jacobian_at_gmx.net
(replace the _at_)

Subject: Re: matrix log and exp
Posted by jeyadev on Thu, 18 Apr 2002 19:39:38 GMT
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In article <a9kgr4$ur8$1@scavenger.euro.net>,
G Karas <jacobianat@gmx.net> wrote:
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It depends on the matrix. Can you diagonlise it? It so,
you are done. You will need a support package to do the
linear algebra, though.

If A is the matrix and you need exp(A), you proceed as
follows:

1. Find the eigenvalues and eigenvectors of A

   such that A u_i = l_i u_i

where u_i is the i-th eigenvector and l_i is the corresponding eigenvalue

2. Form the 'rotation' matrix R = [u_1 u_2 ....] where each e.vector becomes a column. The R' be the transpose of A.

   Now, the product R A R' is a diagonal matrix with the eigenvalues l_i as its diagonal elements. Its exponetial is just the diagonal matrix with elements that are exp(l_i).

   What you have done is find the exponential of the matrix in the representation in which the original A is diagonal. Call this diagonal matrix B.

   B_ij = exp(l_i) d_ij

   where d_ij is the Kronecker delta symbol.

3. Then, exp(A) = R' A R

The trick is to do the basic operation in the diagonal representation and then transform back. If you can write the operation as a power series, then can see why this works.

The same should work for the logarithm, if the e.values are all greater than zero.

--

Surendar Jeyadev jeyadev@wrc.xerox.bounceback.com

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Subject: Re: matrix log and exp
Posted by jeyadev on Fri, 19 Apr 2002 17:21:03 GMT
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In article <a9n7dq$4hu$1@news.wrc.xerox.com>,
Surendar Jeyadev <jeyadev@wrc.xerox.bounceback.com> wrote:
> In article <a9kgr4$ur8$1@scavenger.euro.net>,

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> write the operation as a power series, then can see
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> are all greater than zero.

I forgot to mention that this kind of thing is routine
in quantum mechanical calculations. You will find
information on things like exp(A) in any decent text:
try Schiff or Merzbacher or Gottfried or ....
What I described is routinely used is such calculations.

Hope this helps, but it does assume use of a linear
algebra package for determining the the eigenvalues
and eigenvectors.

Repeated matrix multiplications are tricky! I would
watch out .....

--

Surendar Jeyadev jeyadev@wrc.xerox.bounceback.com

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