

Re: Fast solution to very small eigenvalue problem

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Mark Mackey wrote:

>
> *Hi all.*
>
> *I need to find the eigenvector corresponding to the largest eigenvalue*
> *of a 4x4 matrix very quickly (because I'm doing it on hundreds of*
> *thousands of 4x4 matrices). The current code I'm maintaining has a*
> *simple Jacobi solver, which is (a) slow (it only does 30K matrices/s on*
> *my PC), and (b) probably overkill, as it returns all of the*
> *eigenvectors. I've vaguely looked at LAPACK etc, but those routines are*
> *AFAIK optimised for good performance on large matrices, not small ones.*
>
> *Does anyone have any suggestions as to the most efficient way to solve*
> *this problem? Extreme accuracy is not required. 4x4 is probably small*
> *enough that there's an analytic solution :).*
>
> --
> *Mark Mackey*
> *"The determined Real Programmer can write Fortran programs in any language."*
> *- "Real Programmers don't use Pascal"*

The secular equation for the eigenvalues of a 4x4 matrix is a quartic polynomial. The quartic polynomial can be solved in closed form with radicals. The solution is given in Abramowitz & Stegun, "Handbook of Mathematical Functions".

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"For there was never yet philosopher that could endure the
toothache patiently."
-- Wm. Shakespeare, Much Ado about Nothing. Act v. Sc. 1.