

## An overview of the example collection

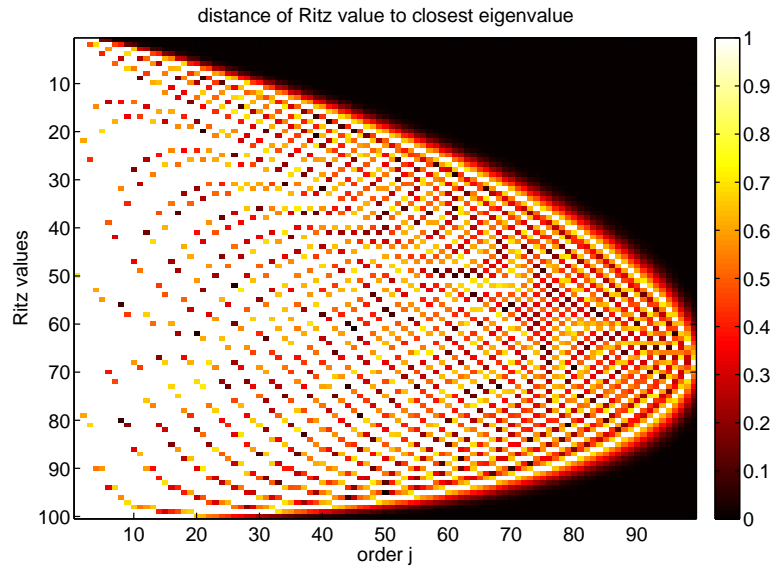
Tags: Overview  
File: index.m  
Date: 10/05/2015

Welcome to this example collection, which intends to demonstrate some of the features of the MATLAB Rational Krylov Toolbox. Simply use the menu on the left-hand side to navigate through the collection. Each example is available as a MATLAB m-file and in PDF format (see the links in the above header). All examples are also included in the `rktoolbox.zip` file available from the *Download* page.

New examples will be added over time and contributions are more than welcome. If you would like to add an example to this collection please email your MATLAB file to `stefan.guettel@manchester.ac.uk`. You can use any m-file of this collection as a template.

Here's a simple example illustrating the fascinating convergence behaviour of rational Ritz values [1]. The matrix  $A$  is diagonal with 100 equispaced eigenvalues in the interval  $[1, 100]$ . Using the rational Arnoldi method [2,3] implemented in `rat_krylov`, we compute Ritz values associated with rational Krylov spaces of increasing dimension with poles alternating between 0 and  $\infty$ . We then visualize the distance of each Ritz value of order  $j = 1, \dots, 99$  to its closest eigenvalue:

```
m = 99; A = spdiags((1:m+1)',0,m+1,m+1); b = ones(m+1,1);
xi = zeros(1,m); xi(1:2:end) = inf;
[V,K,H] = rat_krylov(A,b,xi);
Am = H(1:m,1:m)/K(1:m,1:m);
R = 1*ones(m+1,m);
for j = 1:m,
    ritz = eig(Am(1:j,1:j));
    R(round(ritz),j) = abs(ritz - round(ritz));
end
imagesc(sqrt(R)); colormap(hot(100)); colorbar
xlabel('order j'); ylabel('Ritz values');
title('distance of Ritz value to closest eigenvalue')
```



- [1] B. Beckermann, S. Güttel, and R. Vandebril. *On the convergence of rational Ritz values*, SIAM J. Matrix Anal. Appl., 31:1740–1774, 2010.
- [2] A. Ruhe. *Rational Krylov: A practical algorithm for large sparse nonsymmetric matrix pencils*, SIAM J. Sci. Comput., 19(5):1535–1551, 1998.
- [3] A. Ruhe. *The rational Krylov algorithm for nonsymmetric eigenvalue problems. III: Complex shifts for real matrices*, BIT, 34:165–176, 1994.