Linear Systems

Consider

X'=AX

where A is nxn .If there are n linearly independent eigenvectors for A , {v(1),...,v(n)} , then a fundamental set of solutions is given by {exp(s(i)*t)v(i),i=1..n}.If n is large though this may be hard to find by hand. Here we show how to use Matlab to find the eigenvalues and eigenvectors.

example

Let
A =

-1	0	2
2	3	6
-2	0	-1

Type :

```
***********************
[E,V]=eig(A)
***********************
```

We get

E =

0	0.5000	0.5000
1.0000	0.1000- 0.7000i	0.1000+ 0.7000i
0	0+ 0.5000i	0- 0.5000i

V =

3.0000	0	0
0	-1.0000+ 2.0000i	0
0	0	-1.0000- 2.0000i

The diagonal matrix V lists the eigenvalues of A and the corresponding columns of E are the eigenvectors.Using this information we can write down 3 linearly independent real solutions (a fundamental set).

```
X(1)=exp(3*t)*[0,1,0]'
X(2)=exp(-t)*[0.5*cos(2*t),0.1*cos(2*t)+sin(2*t)*0.7,-0.5*sin(2*t)]'
X(3)=exp(-t)*[0.5*sin(2*t),-0.7*cos(2*t)+0.1*sin(2*t),0.5*cos(2*t)]'
```

Note v' is the transpose of v .

What do you do if there are not n linearly independent eigenvectors? To see how to complete a fundamental set in this case look at Polking, pages 163-170..

ASSIGNMENT 4 :
Write down a real fundamental set if
1.

A =

-0.2	0	0.2
0.2	-0.4	0
0	0.4	-0.2

2.

A =

4	1	1	7
1	4	10	1
1	10	4	1
7	1	1	4