5-1Eigenvalue Methods

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#Note:

This R repository is for demonstration of algorithms involved in the book Mathematical Modeling (4th Edition) written by Prof. Mark. M. Meerschaert

Use yacas() function in R to call Yacas interface in R. The PrettyForm() function in Yacas helps print more intuitive math expressions.

```
#This R repository is for demonstration of algorithms involved in the book
#Mathematical Modeling (4th Edition) written by Prof. Mark. M. Meerschaert
#coded, edited and tested by Hao Li during Dec. 2018 - Jan. 2019.



#Exp5-1 Eigenvalue Methods
#Clear variables
#rm(list = ls())
library(Ryacas)
```

```
##
## Attaching package: 'Ryacas'

## The following object is masked from 'package:stats':
##
##     integrate

## The following objects are masked from 'package:base':
##
##     %*%, diag, diag<-, lower.tri, upper.tri
```

```
#x1 = Sym('x1');x2 = Sym('x2')
yac("f1:=(10/100)*x1-((10/100)/10000)*x1^2-((5/100)/10000)*x1*x2")
```

```
## [1] "x1/10-x1^2/100000-(x2*x1)/200000"
```

```
yac("f2:=(25/100)*x2-((25/100)/6000)*x2^2-((25/200)/6000)*x1*x2")
```

```
## [1] "x2/4-x2^2/24000-(x2*x1)/48000"
```

```
yac("df1dx1:=D(x1) f1")
```

[1] "1/10-x1/50000-x2/200000"

```
yac("df1dx2:=D(x2) f1")
```

[1] "-x1/200000"

```
yac("df2dx1:=D(x1) f2")
```

[1] "-x2/48000"

```
yac("df2dx2:=D(x2) f2")
```

[1] "1/4-x2/12000-x1/48000"

```
yac("A:={{df1dx1,df1dx2},{df2dx1,df2dx2}}")
```

[1] "{{1/10-x1/50000-x2/200000,-x1/200000},{-x2/48000,1/4-x2/12000-x1/48000}}"

```
yac('PrettyForm(A)')
```

[1] "\n/   \\\n| / 1   x1   x2   \\ / /   x1   \\'

```
yac("PrettyForm(S)")
```

[1] "\nS\n\n"

```
yac("B:=Subst(x1,28000/3)A")
```

[1] "{{1/10-28000/3/50000-x2/200000,-28000/3/200000},{-x2/48000,1/4-x2/12000-28000/3/48000}}"

```
yac("B:=Subst(x2,4000/3)B")
```

[1] "{{1/10-28000/3/50000-4000/3/200000,-28000/3/200000},{-4000/3/48000,1/4-4000/3/12000-28000/3/4800

```
yac('PrettyForm(B)')
```

[1] "\n/   \\\n| /   28000   4000 \\ / / 7 \\ \\

```
yac('E:=CharacteristicEquation(B,x)')
```

[1] "(7/75+x)*(1/18+x)-7/5400"

```
yac('E:=Simplify(E)')
```

[1] "(1800*x^2+268*x+7)/1800"

```
yac('PrettyForm(E)')
```

[1] "\n   2   \n1800 * x + 268 * x + 7\n----------------------\n   1800

```
yac('TexForm(E)')
```

[1] "$\\frac{1800 x ^{2} + 268 x + 7}{1800} $\n"

```
yac('lambda:=Solve(E==0,x)')
```

[1] "{x==(Sqrt(1339/202500)-67/450)/2,x==(-(67/450+Sqrt(1339/202500)))/2}"

```
yac('PrettyForm(lambda)')
```

[1] "\n/   \\\n| / 1339 \\   67 |\n| Sqrt| ------