Trefethen p15 to p27.

This notebook showcases the second thirteen problems in Trefethen's classic book *Spectral Methods in MATLAB*. These problems have been ported to Python by Praveen Chandrashekar. Later problems in the set will have been ported to Python by Orlando Camargo Rodríguez.

Program 15 : Solve eigenvalue BVP

In [38]:
```
%matplotlib inline
%config InlineBackend.figure_format='svg'
from numpy import dot,argsort,linspace,shape,zeros,polyval,polyfit,pi,real
#from chebPy import cheb
from scipy.linalg import solve,eig
from matplotlib.pyplot import figure,subplot,plot,title,axis
```

In [2]:
```
from numpy import pi,cos,arange,ones,tile,dot,eye,diag

def cheb(N):
    '''Chebushev polynomial differentiation matrix.
       Ref.: Trefethen's 'Spectral Methods in MATLAB' book.
    '''
    x      = cos(pi*arange(0,N+1)/N)
    if N%2 == 0:
        x[N//2] = 0.0 # only when N is even!
    c      = ones(N+1); c[0] = 2.0; c[N] = 2.0
    c      = c * (-1.0)**arange(0,N+1)
    c      = c.reshape(N+1,1)
    X      = tile(x.reshape(N+1,1), (1,N+1))
    dX     = X - X.T
    D      = dot(c, 1.0/c.T) / (dX+eye(N+1))
    D      = D - diag( D.sum(axis=1) )
    return D,x
```