tolerance

July 23, 2025

1 Integrator tolerances

```
[1]: from casadi import *
     from numpy import *
     from pylab import *
```

```
[2]: x=SX.sym('x')
     dx=SX.sym('dx')
     states = vertcat(x,dx)
```

```
[3]: dae={'x':states, 'ode':vertcat(dx,-x)}
```

```
[4]: tend = 2*pi*3
     ts = linspace(0,tend,1000)
```

```
[5]: tolerances = [-10,-5,-4,-3,-2,-1]
```

```
[6]: figure()
```

```
[6]: <Figure size 640x480 with 0 Axes>
```

```
<Figure size 640x480 with 0 Axes>
```

```
[7]: for tol in tolerances:
         opts = {'reltol':10.0**tol, 'abstol':10.0**tol}
         F = integrator('F', 'cvodes', dae, 0, ts, opts)
         res = F(x0=[1,0])
         plot(ts,array(res['xf'])[0,:].T,label='tol = 1e%d' % tol)
     legend( loc='upper left')
     xlabel('Time [s]')
     ylabel('State x [-]')
     show()
```
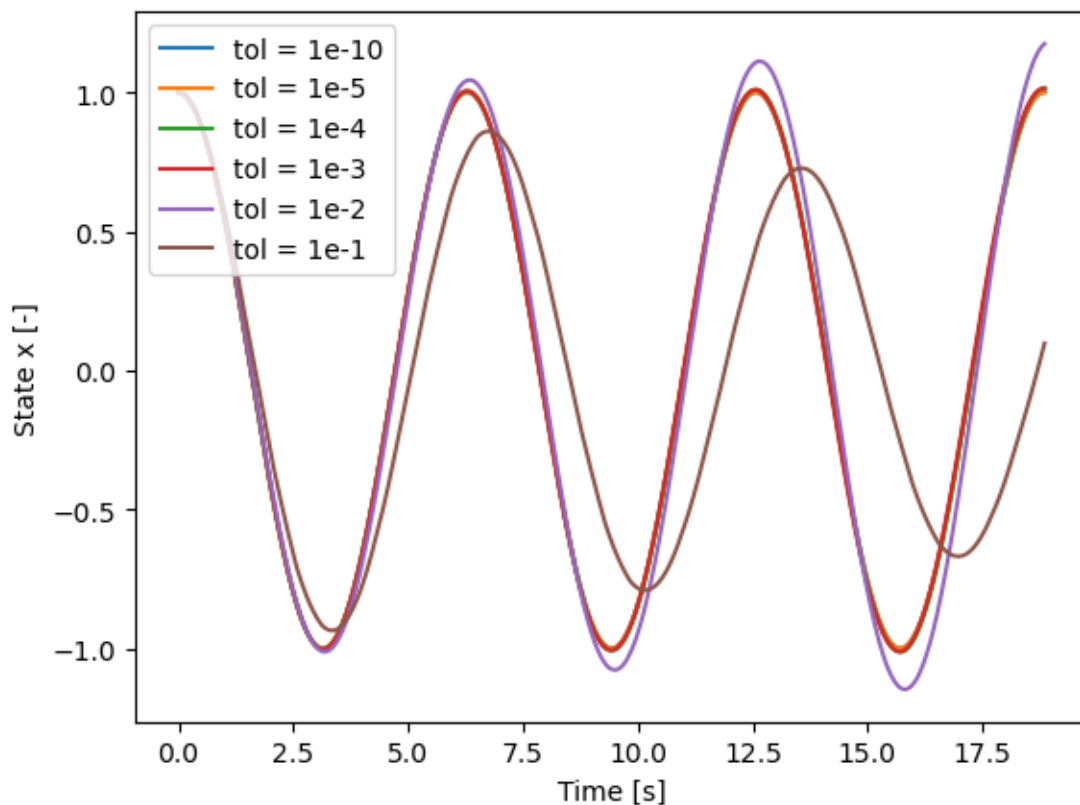


```
[8]: tolerances = logspace(-15,1,500)
     endresult=[]
```

```
[9]: for tol in tolerances:
         opts = {}
```

```
    opts['reltol'] = tol
    opts['abstol'] = tol
    F = integrator('F', 'cvodes', dae, 0, tend, opts)
    res = F(x0=[1,0])
    endresult.append(res['xf'][0])
```

[10]:
```
endresult = vcat(endresult)
```

[11]:
```
figure()
loglog(tolerances,(array(endresult)-1),'b',label='Positive error')
loglog(tolerances,-(array(endresult)-1),'r',label='Negative error')
xlabel('Integrator relative tolerance')
ylabel('Error at the end of integration time')
legend(loc='upper left')
show()
```