

tolerance

April 4, 2023

This file is part of CasADi.

CasADi -- A symbolic framework for dynamic optimization.
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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, 'grid':ts, 'output_t0':True}
      F = integrator('F', 'cvodes', dae, 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()
```

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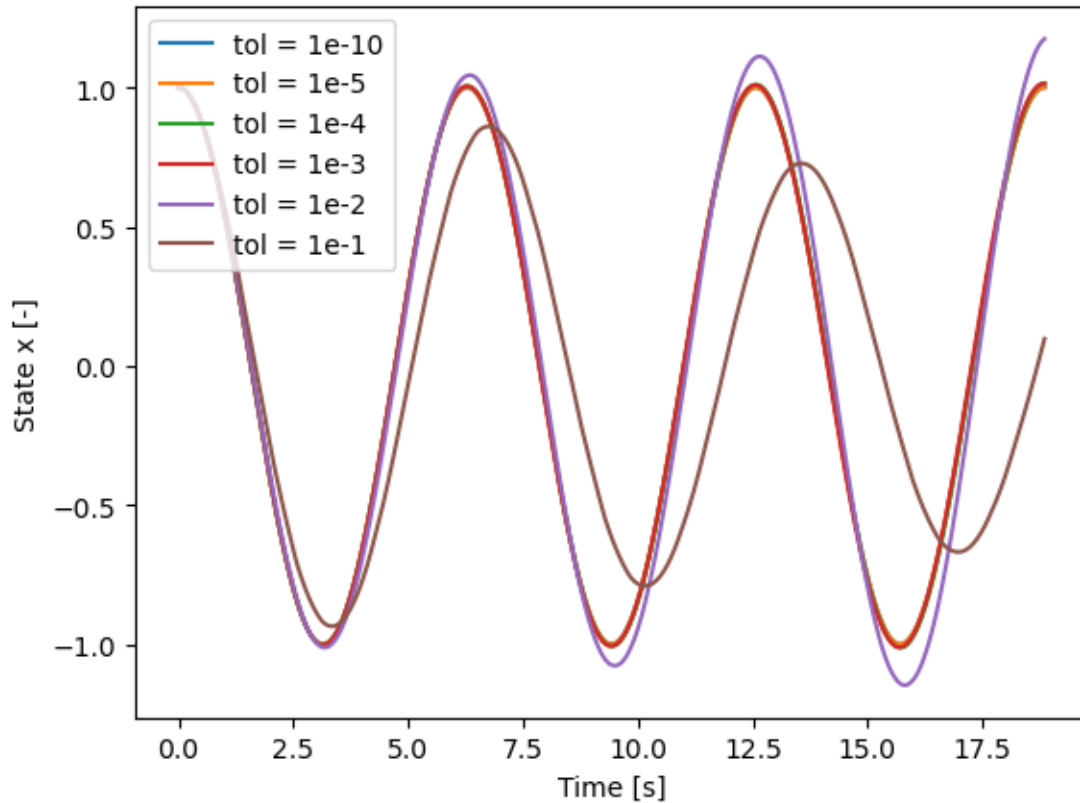
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```
[8]: tolerances = logspace(-15,1,500)
     endresult=[]
```

```
[9]: for tol in tolerances:
      opts = {}
      opts['reltol'] = tol
      opts['abstol'] = tol
      opts['tf'] = tend
      F = integrator('F', 'cvodes', dae, opts)
      res = F(x0=[1,0])
      endresult.append(res['xf'][0])
```

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```

```
[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()
```

