

# tolerance

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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()
```

CasADi - 2023-04-18 20:52:41 WARNING("The options 't0', 'tf', 'grid' and 'output\_t0' have been deprecated.

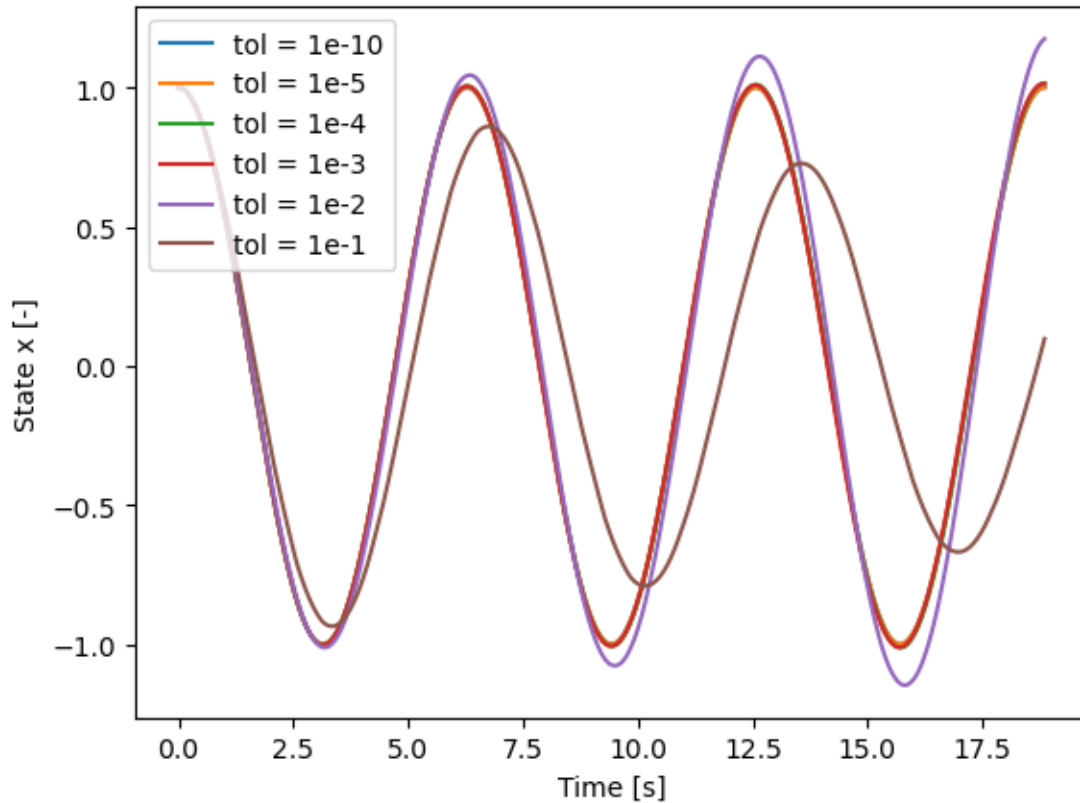
The same functionality is provided by providing additional input arguments to the 'integrator' function, in particular:

- \* Call integrator(..., t0, tf, options) for a single output time, or
- \* Call integrator(..., t0, grid, options) for multiple grid points.

The legacy 'output\_t0' option can be emulated by including or excluding 't0' in 'grid'.

Backwards compatibility is provided in this release only.")

[.../casadi/core/integrator.cpp:499]



```
[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])
```

```
[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()
```

