

# tolerance

August 4, 2024

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 - 2024-08-04 10:58:17 WARNING("The options 't0', 'tf', 'grid' and 'output_t0' have been deprecated.
```

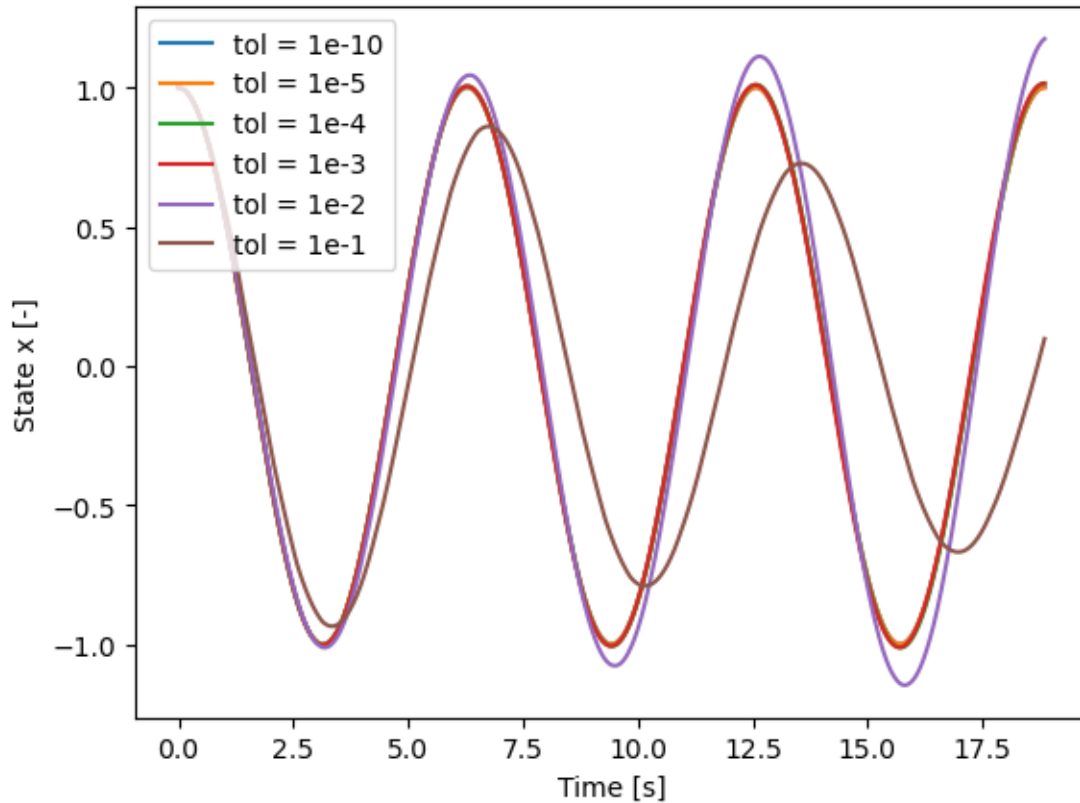
```
The same functionality is provided by providing additional input arguments to the 'integrator' function, in particular:
```

- \* 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:515]
```



```
[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()
```

