Exercise 1 *Step-size controlled solution of the Curtiss–Hirschfelder equation*

The code for this problem can be found in `obelix:~wdobler/Phys535/idl/Curtiss-Hirschfelder`

(a) Numerically solve the Curtiss–Hirschfelder equation for at least $t = 50$.

(b) Adapt '`run.pro`' to make it overplot minimum and maximum of δt instead of the average.

(c) Find the largest error tolerance ***err*** that is acceptable (decision based on the two curves).

(d) Add a third panel showing the difference between the numerical solution and $\cos t$. Compare with exact result, and find again the largest acceptable value of ***err***.

Exercise 2 *Van der Pol equation*

Now "vectorize" the files from the Curtiss–Hirschfelder experiments and use them to solve the van der Pol equations

$$\ddot{y} = -y + \mu(1 - y^2)\dot{y} \tag{1}$$

for $\mu = 5$.

Note: It is best to start with a full copy of the Curtiss–Hirschfelder directory.

(a) Write Eq. (1) as a system of two first-order equations.

(b) Now adapt the files `start.pro`, `pde.pro`, `run.pro`, and '`print.pro`' to make them work with a 2-element array `f`.

(c) Adapt '`README`', so you can still use this setup in a year from now…

(d) Plot $y(t)$, $\dot{y}(t)$, $\dot{y}(y)$, and $\delta t(t)$.

(e) How does the parameter μ affect the behaviour of the time step $\delta t(t)$?