

1 High order ODEs

We set

$$\mathbf{z}(t) = \begin{pmatrix} z_0(t) \\ z_1(t) \\ z_2(t) \\ z_3(t) \end{pmatrix} = \begin{pmatrix} y(t) \\ \dot{y}(t) \\ \ddot{y}(t) \\ \dddot{y}(t) \end{pmatrix}$$

and we obtain

$$\dot{\mathbf{z}}(t) = \begin{pmatrix} z_1(t) \\ z_2(t) \\ z_3(t) \\ \cos(z_2(t)) + z_1(t)e^{-5t} \end{pmatrix}$$

with initial condition

$$\mathbf{z}(t_0) = \begin{pmatrix} 0 \\ 3 \\ -1 \\ 0 \end{pmatrix}$$