Notes on Numerical Optimization Methods

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1 Solution of Initial Value Problems

The general form of a first order initial value problem (IVP) can be stated as follows[1]:

$$\frac{\mathrm{d}z}{\mathrm{d}t} = f(z,t), \qquad t \in [0, t_f]; \tag{1a}$$

$$z(0) = z_0. \tag{1b}$$

The dependent variable z is a vector of m components. The independent variable t is a scalar within the specified range from 0 to t_f.If t does not appear explicitly in the governing equation $f(\cdot)$, the system is called *autonomous*. Otherwise, the system is *nonautomonous*. The initial state of the system is given by a known parameter vector z_0.

[1] Different notation for differentiation

Gottfried Leibniz	$\frac{\mathrm{dz^n}}{\mathrm{dt^n}}$
Joseph Louis Lagrange	$z'(t), z''(t), ..z^n(t)$
Isaac Newton	$\dot{z}, \ddot{z}, ..$