Contents

1 Doctor's program

`https://www.youtube.com/playlist?list=PLo4jXE-LdDTQbSErI2ftYD4PLJjVMaiox`

1.1 Numerical problems

1.1.1 ODE

$$\begin{cases} \dfrac{dy}{dt} = f(y(t), t) \\ y(1) = y_0 \end{cases} \tag{1}$$

1.1.2 Integral

$y(t) = y(t_0) + \int_{t_0}^{t} f(y(s), s)\mathrm{d}s$

1.2 Consequences of choice in method

- $\overline{Y(t_n)}$ EDO solution in $t = t_n$ (function)
- y_n discrate solution (numerical method) (vector)

1.2.1 Using Taylor's series

$$\begin{aligned} \overline{Y}(t_n + 1) &= \overline{Y_n} + \Delta t.\overline{Y}'(t_n) + O(\Delta t^2) \\ \implies \overline{Y}(t_n + 1) &= \overline{Y_n} + \Delta t.f(\overline{Y}(t_n), t_n) + \Big|_{\text{cut}} O(\Delta t^2) \end{aligned} \tag{2}$$

$$\begin{aligned} y_{n+1} &= y_n + \Delta t.f(y_n, t_n) \\ &= y_n + \Delta t.\Delta f_n \end{aligned} \tag{3}$$

1. Euler Explicit method

2 Euler Implicit

Use $y_{n+1} = y_n - \Delta t.f(y_{n+1}, t_{n+1})$

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