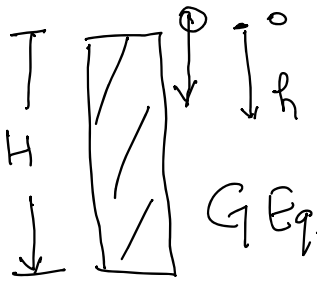
Example



To find t_H

GEq. $-\frac{d^2h}{dt^2} = g$

Data $t = 0 \quad h = 0$

$\frac{dh}{dt} = 0$

Solution $\frac{dh}{dt} = gt + a$

$h = \frac{gt^2}{2} + at + b$

Applying ICs $a = b = 0$

$h = \frac{gt^2}{2}$

$$\boxed{t_H = \sqrt{\frac{2H}{g}}}$$

$H = 666\ m$

$g = 9.81\ m/s^2$

$t_H = \sqrt{\frac{2 \times 666}{9.81}} = \sqrt{135.7982}$

Babolyian algorithm $x = \sqrt{a}$

1. x_0 — Guess value
2. $x_1 = \frac{1}{2}\left(x_0 + \frac{a}{x}\right)$
3. $\vdots$

$x_{n+1} = \frac{1}{2}\left(x_n + \frac{a}{x_n}\right)$

$x_1 = \frac{a}{x_0}$

Apply

$x_0 = 11$

$x_1 = \frac{1}{2}\left(11 + \frac{135.7982}{11}\right)$

$= 11.6718$

$x_2 = 11.6525$

$x_3 = 11.6525$ $\quad t_H = 11.6525_s$

- Which problem to solve [ODE, Square root]
- Significant digits
- Which algorithm?
- Converge / Convergence rate
- What is the error in the result?

Error
- Model error
- Data error -
  - Propagation of error
- Round-off error
- Truncation error

Condition number / Stability

Number representation in computer

- Binary digits 0 or 1

11010000

208

11 01 0000 . 101

$208 + 1\times2^{-1} + 0\times2^{-2} + 1\times2^{-3}$

$= 208.625$

1 bit

8 bit - byte

32-bit - word

64-bit - double word

- Digital computers

0 & 9 [Decimal]

118

$1\times10^2 + 1\times10^1 + 8\times10^0$

118.25

$1\times10^2 + 1\times10^1 + 8\times10^0 + 2\times10^{-1} + 5\times10^{-2}$

3 Number systems

- Integer
- Fixed point
- floating point