ME564 L20

$$\overbrace{\quad\quad\quad\quad\quad}^{1/\Delta t}$$

$O(\Delta t^5) \times \frac{1}{\Delta t} \to O(\Delta t^4)$

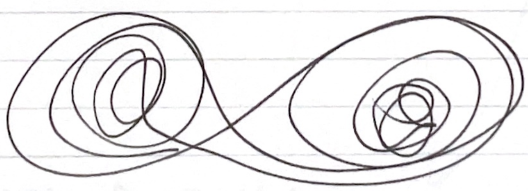
Local $O(\Delta t^5)$
global $O(\Delta t^4)$ proprtional to Δt

Not true to Chaotic System!

Integrating Chaotic system, just a little local integration error could lead to total Chaos (exponential growth)

but still saturated at some points like Lorentz tracker

$\varepsilon e^{\lambda t}$ → Lyapunov exponent



$\varepsilon e^{\lambda t}$

$10^{-16} e^{t}$ assume $\lambda = 1$, we can get when $t = ?$ will we ~~ca~~ stop to tolerant our error

machine precision

No.

Date

How to evaluate precision?

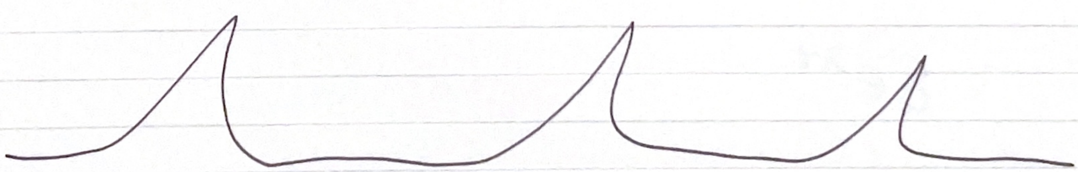
→ cut Δt smaller

Sympletic
variational Integrators | Hamiltonian
Lagrangian

$\cancel{H = T + V \Rightarrow}$

$$H(q,p) = T + V \Rightarrow \dot{q} = -\frac{\partial H}{\partial p}$$
$$\dot{p} = \frac{\partial H}{\partial q}$$

maintain some conservation properties



$$\frac{d}{dt}\begin{bmatrix}\theta_1\\ \theta_2\\ \omega_1\\ \omega_2\end{bmatrix} = f\left(\begin{bmatrix}\theta_1\\ \theta_2\\ \omega_1\\ \omega_2\end{bmatrix}\right)$$

double pendulum & three-body problem

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