ME564 L20

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

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

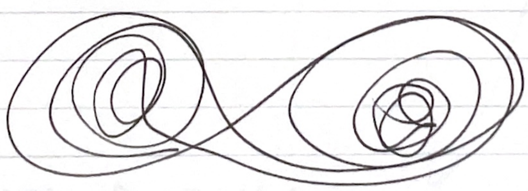
Local $O(\Delta t^5)$
global $O(\Delta t^4)$ $\leftarrow$ proprional to $\Delta t$

Not true to Chaotic System!

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

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

but still saturated at some points like Lorentz tracker



$\varepsilon e^{\lambda t}$

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

$\uparrow$
machine precision

No.

Date

How to evaluate precision?

→ cut $\Delta t$ smaller

Sympletic
variational Integrators | Hamiltonian
Lagrangian

~~H=T+V =>~~

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

$$\dot{p} = \frac{\partial H}{\partial q}$$

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