Course 565 / 665 Lecturer Prof. Cavagnero
Day 2.3.04 Date 9:55 am
Notes Taken By Jiang Hong Total Number of Pages

$$\left.\frac{dV(x)}{dx}\right|_{x=minimum} = 0 \Rightarrow X_{min} = 0$$

$$\frac{d^2V(x)}{dx^2} = 2mg > 0$$ verify this is a minimum.

Extremum Principle #1 (part A)

Systems tend towards a state of minimum energy.

In other words, systems tend to a state where they minimize their degrees of freedom.

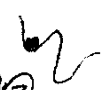
degrees of freedom — Variables that is allowed to change

Equilibrium (Eq.): is a state of a system where the system "tends to go and stay", I.e., A state where energy V is minimized. $f = \frac{-dV(x)}{dx} = 0$ (f: force)

A state where the forces acting upon a system (f) are "zero".


① stable Eq. $V = V_{min}$


② neutral Eq. V is a constant.


③ metastable Eq. $V = V_{local\ min.}$


④ unstable Eq. $V = V_{max}$

1st of 3

Course 565 / 665 Lecturer Prof. Cavagnero
Day 2.3.04. Date 9:55 am
Notes Taken By J. Hong Total Number of Pages

Criteria for different kinds of Eq.:

①: $\frac{dV}{dx} = 0 \quad \frac{d^2V}{dx^2} > 0$

②: $\frac{dV}{dx} = 0$ for all X.

③: $\frac{dV}{dx} = 0$, $\frac{d^2V}{dx^2} > 0$, If you perturb the system

for: $|X - X_{\substack{min \\ loc.}}|$ small (small displacement)

$V_{(x)} - V_{(x_{min})} > 0$

for: $|X - X_{\substack{min \\ loc.}}|$ large (large displacement)

systems evolves towards "stable Eq."

$V_{(x)} - V_{(x_{min})} < 0$

④ $\frac{dV}{dx} = 0 \quad \frac{d^2V}{dx^2} < 0$

$V_{(x)} - V_{(x_{max})} < 0$

Extreme Principle #1 Part B

Systems tend towards a state of "stable Equilibrium"

2nd of 3

Course 565 / 665 Lecturer Prof. Cavagnero
Day 2.3.04 Date 9:55 am
Notes Taken By J. Hong Total Number of Pages

For a binomial distribution:

$$P_{comp.} = P_{seq} \cdot W = P_H^M (1-P_H)^{N-M} \frac{N!}{M!(N-M)!}$$

consider $N = 4$. $N = \infty$, W_{max} for $m = N/2$ (general case actually)

Extreme principle # 2

Systems tend towards a state of maximum W (all other states become negligibly populated as N increase)

$\Rightarrow$ This max W $\Rightarrow$ $\begin{cases} 50\% \ T \\ 50\% \ H \end{cases}$
(for coin flips)

3rd of 3