Dynamical System

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$\underline{x}$: displacement

$\underline{u} = \dot{\underline{x}}$: velocity

$\underline{a} = \ddot{\underline{x}}$: acceleration

$$\underline{a} = \frac{d\underline{u}}{dt} = \frac{d\underline{x}}{dt} \cdot \frac{d\underline{u}}{d\underline{x}} = \underline{u} \cdot \frac{d\underline{u}}{d\underline{x}}$$

Newton's 2nd Law of Motion

Force, $\underline{F} \propto \underline{a}$

Newton's 2nd Law of Motion: $\underline{F} = m\underline{a}$

where m : mass

$\underline{F} = \underline{F}_S + \underline{F}_B$ ($\underline{F}_S$: surface force, $\underline{F}_B$: body force)

Electromagnetic force, $\underline{F} = \underline{F}_e + \underline{F}_m = q\underline{E} + q\underline{u} \times \underline{B}$ ($\underline{F}_e = q\underline{E}$: electric force, $\underline{F}_m = q\underline{u} \times \underline{B}$: magnetic force)

Workdone, $W = \underline{F} \cdot \underline{x}$