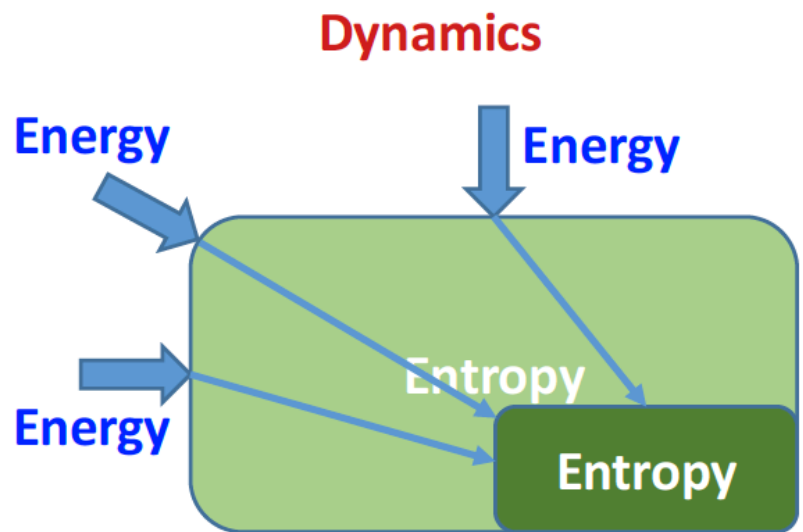




# Local trade of energy versus entropy – Dynamics

- According to the classical laws of physics, entropy can only increase. Intuitively speaking, this means that disorder keeps growing. This is globally true.
- Nevertheless, science and experience also indicate that at the expense of a certain amount of energy, locally, i.e. in a restricted domain, a certain order and structure can be established, entropy can be reduced.



- This is precisely what life and controllers, notably, can achieve.
- Dynamics is here the appropriate word, as it primarily links the concepts of energy and changes as time goes. Many interesting notions appear in this context, namely work, force, motion, displacement, power, change, speed, control and entropy.
- Etymology shows that the word “dynamics” stems from the Ancien Greek “dúnamis”, usually translated as “power”. Physics define power as the change in energy that can be performed in one time unit, i.e. in one second. In thermodynamics, work is energy, and the rate, the speed at which work is performed, is power.
- Motions provide an intuitive way to describe energy (i.e. also work); thus, energy is the product of a force by a displacement.
- In a more abstract and general way, energy (i.e. also work), can be equivalently defined as the product of a cause, by its effect.
- Coming back to the notion of power, we notice that energy is also the product of a power by time, that is to say implicitly that the power is the cause of a change, and the time, the duration of this work.
- Thus control, and more generally, life, use energy to orient changes towards an arbitrary goal, thereby reducing entropy in a certain domain.

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