GENERAL PRINCIPLES OF SUSTAINABLE ENERGY SYSTEMS

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The purpose of research - on the basis of the main provisions of the stability theory of the formation of the conditions and criteria of the linear stability for small perturbations.

Materials and methods of research. A state far from equilibrium, may lose its stability and move to one of the many possible states. Driven by internal fluctuations or other small impacts the system goes to one of the many possible new states. These new conditions can be highly organized.

The wording of the Lyapunov stability conditions determines a precise mathematical form (with a clear intuitive meaning).

The concept of sustainability is not limited to a stationary state; it can be extended to the periodic state. However, since here we study the stability of nonequilibrium steady states, we will not consider the stability of periodic (oscillatory) states.

The results of research. Entropy - a function with a certain sign for any thermodynamic system.

Since such a nonequilibrium steady state, thermodynamic forces and the corresponding flows of energy and matter do not vanish.

Consequently, the first variation is different from zero. The second variation is a definite sign and is defined as

$$\frac{1}{2}\delta^2\dot{S} = \int_V \delta\nabla\left(\frac{1}{T}\right)\delta J_u dV - \int_V \sum_k \delta\nabla\left(\frac{\mu_k}{T}\right)\delta J_k dV + \int_V \left[\sum_i \delta\left(\frac{A_i}{T}\right)\delta\upsilon_i\right] dV = \sum_\alpha \delta F_\alpha \delta J_\alpha ,$$

where $\sum$ - surface bounding volume V, and d a - the element of surface area.

Investigation of the stability of power systems allows for steady-state operation conditions of the phenomenon, and to identify ways for reliable operation.