UDC 519.95:530.1:539+004.45:004.942
DOI: https://doi.org/10.30837/IYF.CVSAMM.2024.155

STUDYING CATASTROPHES FOR FINDING THE BEST WAY OUT OF WAR

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У світі науки і техніки настає час, коли вивчення криз і катастроф стає ключовим напрямком досліджень. Надзвичайні події, неврожаї чи, скажімо, війни – все це результати самоорганізації відкритих систем. Важливо розуміти, що розвиток таких систем проходить еволюційний і революційний етапи. Метою цього дослідження є розробка стратегій прогнозування, подолання та відновлення після катастроф. Системи, включаючи людські, технічні та природні компоненти, проходять еволюційні та революційні стадії розвитку, де зростання напруги може призвести до катастрофічних трансформацій.

Scientific research on crises and catastrophes reveals common patterns and helps identify bifurcation points, where even a small impact can lead to a catastrophe. Since any war accelerates the system towards critical points, the task of optimal exit from war essentially comes down to managing the system at the bifurcation point. To obtain a function of control, it is necessary to define and the functioning goal, the process's coordinates, and the control parameters:

$$X = f(y,\alpha,\beta,...,\Omega),\ P = \varphi(y,\alpha,\beta,...,\Omega),$$

where y is the system's output; $\alpha,\beta,...,\Omega$ are control parameters.

However, in the wartime, the role of the defensive subsystem increases rapidly, which affect the control function of the system:

$$P = \varphi(y,\alpha,\beta,...,\Omega) - \mu(x).$$

In Fig. 1, we can see several variants of the system's behavior with expenditures on the defensive subsystem. Regardless of this, increasing expenditures on it approaches the bifurcation moment and affects system's stability during this period. Therefore, optimal control in wartime consists of the ability to correctly assess the threat from the opponent on one hand and the ability to limit the resources going to the defensive subsystem and redirect these resources to transition to a new product (this task also includes the subtask of increasing the efficiency of the defensive subsystem for $\mu(x) \to 0$), for the optimal passage the bifurcation point.

In Fig. 2, you can see the transition of the system to a new resource under the condition of expenditures on the defense subsystem.

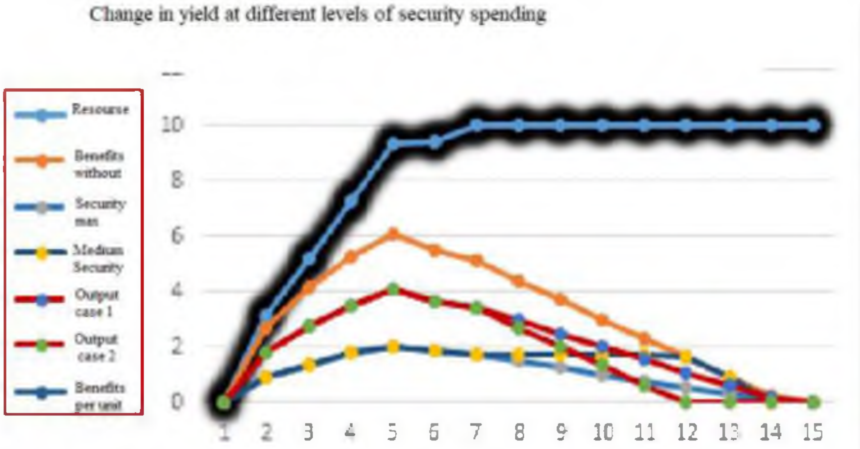

Figure 1 – Dependency of the system's output on defense expenditures

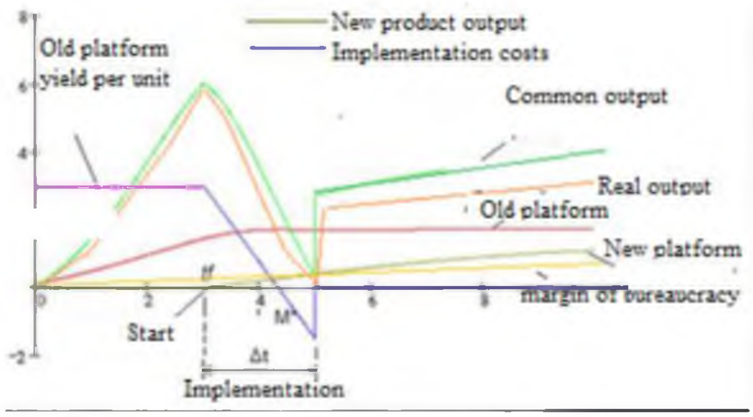

Figure 2 – Dependency of the system's output
on marginal defense expenditures

To ensure the system's transition to a new trajectory, the cost function of the defensive subsystem must satisfy inequalities for all non-negative x:

$$\mu(x) < s_0 / y - K,$$

where $K = \Omega/\Delta t$ is the proportionality coefficient of structure transformation.

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