poster

The nonlinear dynamics of the business center in Beckmann's model

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The economical activity is characterized by a certain time and place so it is natural to take into account the spatial dependence during the simulation of the nonlinear evolution of economic models.

Different cities like New York, Stockholm, Paris and Tokyo represents some examples of complicated spatial urban forms. Usually such cities are called "parent states". In advanced and developing countries the centralization of cities was observed. But now we can see opposite processes of decentralization even in some leading states.

From this point of view the spatial approach for the dynamical market model is one of the most interesting and promising approaches. It allows us to investigate an evolution of the internal structure of a city.

In this paper we present results of the computer simulation of the dynamical market model

$$\frac{\partial \lambda}{\partial t} + div(\chi(\lambda) grad \lambda) = -z(\lambda), \tag{1}$$

where $\lambda(x_1, x_2) > 0$ is a local cost of goods, χ is the coefficient of "diffusion", $z(\lambda) = \lambda^2(1-\lambda)$ is the local surplus of the offer.

The boundary conditions corresponds to optimal trade conditions between market regions. We consider the dynamics of the spatial economics (potential function λ) which is given by the following expression

$$\lambda = x_1^3 - 3x_1x_2^2 + \alpha x_1 + \beta x_2 \tag{2}$$

at the initial moment.

On the basis of our computer simulation we have investigated the dynamics of the city center formation and demonstrated that different urban systems can exist:
1. one-kernel systems (Austria, Tailand);
2. two-kernel systems (Portugal);
3. multi-kernel systems (Polsha).

There are different variants of the big city location in one-kernel urban systems:
1. the central location of the capital as in Spain (Madrid);
2. the displacement of the capital as in Austria (Wien);
3. the peripherical location of large cities in Africa and Asia.