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Energetic model of population growth

In work the new model of growth of the population, so-called energetic model of growth for population

$\frac{dL}{dt} = \delta L \quad \delta: \int\limits_G B(a)e^{-\lambda a}da = 1, \quad \lambda = \delta + \beta + \gamma\, r, \quad L(t) = \left(\sum\limits_{j=0}^{\infty} c_j^p e^{\alpha_j t}\cos(\beta_j t)\right)^{1/p}$, $(p = 2)$,

is constructed and energetic theory of population growth is also investigated. This model is received for one and n countries, where $L(t) = \left(\int\limits_G \varphi(\eta)\, N^p(\eta)\, d\eta\right)^{1/p}$, $0 < p < \infty$. Here

$B(a) = B_0(a)e^{-p\int\limits_0^a F_0(\xi)d\xi}$ is function of survival rate of the population, $\varphi(\eta)$ is some non-negative function with a condition, $\varphi(x, a, t) = \int_a^{\infty} e^{-\int\limits_a^{\xi} F_o^*(\eta)d\eta + \delta(a-\xi)} B_0^*(\varsigma)\, \varphi(x + r(\varsigma - a), 0, t - a + \xi)d\xi$, $\int\limits_G \varphi(\eta)\, d\eta = 1$; $N(\eta) = N(x, a, t)$, $N(\eta) = \sqrt[p]{\frac{\varphi(\eta)}{\int\limits_0^{\infty}\varphi^2(\varsigma)\, d\varsigma}}\; L(t)$, and values of α_j β_j - are solutions of system $\int\limits_G B(a)e^{-\alpha_j a}\cos\beta_j a\, da = 1$, $\int\limits_G B(a)e^{-\alpha_j a}\sin\beta_j a\, da = 0$.

It is should out that energetic model is constructed on the base of some initial groups of the models, describing growth of a population in view of age structure and spatial distributions:

1.
$$\begin{cases} \left(\frac{\partial}{\partial t} + \frac{\partial}{\partial a}\right) N = -F_0(a)N,\ 0 < a < \infty,\ 0 < t < t_r \\ N(a,\, 0) = N_0(a), \quad 0 \le a < \infty, \\ N(0,\, t) = \sqrt[p]{\int\limits_0^{\infty} B_0(a)N^p(a,t)\, da}, \\ \qquad\qquad (a,t) \in G \end{cases}$$

2.
$$\begin{cases} \left(\frac{\partial}{\partial t} + \frac{\partial}{\partial a} + r\frac{\partial}{\partial x}\right) N = -F_0(a)N,\ 0 < a < \infty, 0 < t < t_k \\ N(x, a,\, 0) = N_0(x, a), \quad 0 \le a < \infty,\ 0 < x < L, \\ N(x, 0,\, t) = \sqrt[p]{\int\limits_0^{\infty} B_0(a)N^p(x,a,t)\, da},\ 0 < x < L, \\ N\,|_{x=0} = 0 = N\,|_{x=0}\ , \end{cases}$$

3. *Models in view of a diffusion distributions* $, (x, a, t) \in G$.

The series of computer experiments were carried out for initial functions described with help of uniformly and normal distributed laws.