Energetic model of population growth

In work the new model of growth of the population, so-called energetic model of growth for population
\[
\frac{dL}{dt} = \delta L \int G B(a) e^{-\lambda a} da = 1, \quad \lambda = \delta + \beta + \gamma r, \quad L(t) = \left( \sum_{j=0}^{\infty} c_j^p e^{\alpha_j t} \cos(\beta_j t) \right)^{1/p},
\]
\[(p = 2),
\]
is constructed and energetic theory of population growth is also investigated. This model is received for one and n countries, where
\[
L(t) = \left( \int_G \varphi(\eta) N^p(\eta) d\eta \right)^{1/p}, \quad 0 < p < \infty.
\]

Here \(B(a) = B_0(a) e^{-\int_0^a F_{00}(\xi) d\xi}\) is function of survival rate of the population, \(\varphi(\eta)\) is some non-negative function with a condition, \(\varphi(x, a, t) = \int_0^\infty e^{-\int_0^\xi F_{00}(\eta) d\eta + \delta (a - \xi)} B_0(\xi) \varphi(x + r(\xi - a), 0, t - a + \xi) d\xi, \int_0^\infty \varphi(\eta) d\eta = 1; N(\eta) = N(x, a, t), N(\eta) = \frac{\varphi(\eta)}{\int_0^\infty \varphi^2(\zeta) d\zeta} L(t),\) and values of \(\alpha_j, \beta_j\) are solutions of system
\[
\int G B(a) e^{-\alpha_j a} \cos(\beta_j a) da = 1, \int G B(a) e^{-\alpha_j a} \sin(\beta_j a) da = 0.
\]

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. \[
\begin{cases}
\left( \frac{\partial}{\partial t} + \frac{\partial}{\partial a} \right) N = -F_0(a) N, & 0 < a < \infty, \quad 0 < t < t_r \\
N(a, 0) = N_0(a), & 0 \leq a < \infty, \\
N(0, t) = \int_0^\infty B_0(a) N^p(a, t) da,
\end{cases}
\]
\[(a, t) \in G\]

2. \[
\begin{cases}
\left( \frac{\partial}{\partial t} + \frac{\partial}{\partial a} + r \frac{\partial}{\partial x} \right) N = -F_0(a) N, & 0 < a < \infty, 0 < t < t_k \\
N(x, a, 0) = N_0(x, a), & 0 \leq a < \infty, \quad 0 < x < L, \\
N(x, 0, t) = \int_0^\infty B_0(a) N^p(x, a, t) da, & 0 < x < L, \\
N |_{x=0} = 0 = N |_{x=0},
\end{cases}
\]

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.