So, in conclusion we must admit that colour is a means of art expression, it promotes the manifestation of volumes, the planes, details. With the help of colour, we can emphasize the main purpose of the building in an architectural complex. Besides, colour has influence on human psychological state. That is why we should pay more attention to colour in architecture.

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UDC 77.03

DYNAMICS OF MULTI-SPAN BEAMS ON NONLINEAR ELASTIC TIES UNDER ARBITRARY LOAD

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In this paper we propose a method that simplifies the creation of mathematical models of the dynamics of beam systems with an infinite number of degrees of freedom, a large number of boundary conditions and the composition of active forces. The method is based on the iterative solution of the equations of the dynamics of the free beam under the action of many forces, which included support reactions.

Consider the solution of the problem of vibration of an elastic beam on an elastic mass on an elastic sealing, as shown in Figure 1.

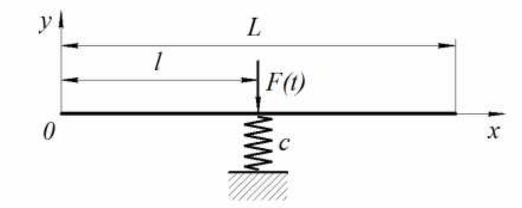

Fig. 1

In order to explain the advantages of the proposed method of solution, compare it with the traditional method of solution of the problem decomposition to their own forms.

In accordance with this method, the displacement y(x, t) of any point of the beam at any point in time is represented as a sum of products of functions of the form $W_k(x)$ on a temporary function $G_k(t)$:

$$y(x, t) = \sum_{k=1}^{\infty} W_k(x) G_k(t), \tag{1}$$

where k – number of waveforms.

Time function depends on the type of exposure (impulse, step, or a harmonic or more). For this example, assume that the exposure step, i.e. at time t = 0 at the center beam by the force applied F(t) = Fo, which continues to operate for an indefinitely long period of time.

The shape function depends only on the coordinates x and in a general way for beams of constant cross section is determined by the function Krylov.

$S(\alpha kx)$, $T(\alpha kx)$, $U(\alpha kx)$, $V(\alpha kx)$:

$Wk(x) = C1 \cdot S(\alpha kx) + C2 \cdot T(\alpha kx) + C3 \cdot U(\alpha kx) + C4 \cdot V(\alpha kx)$,

C – constants determined by the boundary conditions;

$S(\alpha kx) = 0.5\,(ch(\alpha kx) + \cos(\alpha kx))$,

$T(\alpha kx) = 0.5\,(sh(\alpha kx) + \sin(\alpha kx))$,

$U(\alpha kx) = 0.5\,(ch(\alpha kx) - \cos(\alpha kx))$,

$V(\alpha kx) = 0.5\,(sh(\alpha kx) - \sin(\alpha kx))$ – Krylov function.

In this example, the left end of the beam *(at x = 0)* and no reaction in the sealing of time, therefore, the second and third derivatives of the shape function are equal to zero, this in turn means that the constants *C3* and *C4* are also zero. From the shape function of the first two terms are:

$$Wk\ (x) = C1 \cdot S\ (\alpha kx) + C2 \cdot T\ (\alpha kx). \tag{2}$$

When moving from the left to the right end of the beam after passing through the intermediate support to form additional term function *W (x) = DV (αk (xl)),* where l – coordinate support, so when 1 x shape function has the form:

$$Wk\ (x) = C1 \cdot S\ (\alpha kx) + C2 \cdot T\ (\alpha kx) + DV\ (\alpha k\ (x\text{-}l)). \tag{3}$$

Dn – constant determined by the magnitude of the amplitude R from the elastic sealing: *D = R / α3EJ*. To determine the constant D we obtain the expression:

$$D_k = -\frac{cW_k(l)}{\alpha^3{}_k EJ} = -\frac{c}{\alpha^3{}_k EJ}(C_1\mathrm{S}(\alpha l) + C_2\mathrm{T}(\alpha l)) \ . \tag{4}$$

The right end of the beam (as well as the left) is free, so the second and third derivatives at *x = L* are equal to zero.

As a result of reforms and expressing *C1* through *C2* obtain the frequency equation:

$$f(\alpha) = T(\alpha L) + S(\alpha l)S(\alpha(L-l))\frac{c}{\alpha^3 EJ} - \frac{U(\alpha L) + S(\alpha l)T(\alpha(L-l))\frac{c}{\alpha^3 EJ}}{V(\alpha L) + T(\alpha l)T(\alpha(L-l))\frac{c}{\alpha^3 EJ}}\left[U(\alpha L) + T(\alpha l)S(\alpha(L-l))\frac{c}{\alpha^3 EJ}\right] \ . \tag{5}$$

As mentioned earlier, in this example, the case of the step of loading the design. With zero initial conditions for each form of motion is described by the well known relation to fluctuations in the system with one degree of freedom with damping. Only instead of mass, stiffness, damping coefficient and natural frequency should be replaced by their equivalent values:

$$G_k(t) = \frac{P_k}{c_k}\left[1 - e^{-h_k t}(\cos(\sigma_k t) + \frac{h_k}{\sigma_k}\sin(\sigma_k t)\right]. \tag{6}$$

Expression (6) is the time function, as discussed in the beginning. As a result of transformation, substituting the expression (6) in (1) we obtain the equation to obtain the coordinates of any point of the elastic system at any time.

Now consider the method proposed in this paper to solve the same problem. Represent beam lying on an elastic support (and generally any number of resilient supports), as a free beam. In this case, we do not need to be bulky frequency equation and the shape function. Frequency equation and the function of the free form of the beam are easy to deduce or take from the directory:

$$f(\alpha) = V(\alpha L)T(\alpha L) + U(\alpha L)^2,$$

$$W_k(x) = \frac{V(\alpha kL)}{U(\alpha kL)} \cdot S(\alpha_k x) + T(\alpha_k x).$$

Taking into account the dynamics of the beam equation notation is as follows:

$$M_k \ddot{G}_k + 2h_k m_k \dot{G}_k + c_k G_k = P_k(t), \tag{7}$$

where *Pk(t)* – the sum of the forces acting on an equivalent weight:

$$P_k(t) = (-F(t) - cy(l,t))W_k(l) = -(F(t) - c\sum_{k=1}^{\infty} W_k(l)G_k(l),$$

where *F(t)* – dependence of the driving force from time to time;

y (l, t) – the movement of the point of attachment to the elastic sealing of the beam.

Knowing the initial conditions for the function of time, we find its new value at time $t_{i+1} = t_{i+\tau}$. To do this, we consider the solution of the differential equation of motion (7).

Equation (7) is a non-homogeneous differential equation of the second order. Its decision is made up of the general solution of the homogeneous equation and a particular solution of the inhomogeneous equation:

$$G(t) = Go(t) + Gch(t).$$

Particular solution of the inhomogeneous equation describes the natural oscillations and contains two arbitrary constants, which are determined by the initial conditions:

$$G_o(t) = e^{-ht}(C_1\cos(\sigma t) + C_2\sin(\sigma t)).$$

A particular solution of the inhomogeneous equation describes the forced motion of the system after a complete decay of natural oscillations and constant right-hand side can be written as [3]:

$$G_ч(t) = \frac{P}{c}\left[1 - e^{-ht}(\cos(\sigma t) + \frac{h}{\sigma}\sin(\sigma t)\right].$$

Thus, the general solution of the inhomogeneous equation has the form:

$$G(t) = e^{-ht}(C_1\cos(\sigma t) + C_2\sin(\sigma t)) + \frac{F}{c}\left[1 - e^{-ht}(\cos(\sigma t) + \frac{h}{\sigma}(\sigma t))\right]. \quad (8)$$

After transformations we obtain the final expression with which the initial conditions and the values of all the forces acting can calculate the new value of *G* and its first derivative.

Due to the linearity of the equation (7) to improve the accuracy, stability and speed of the algorithm of its solution instead of the usual numerical methods, such as methods of Euler or Runge-Kutta, conveniently at each integration step used an analytical approach. Consider a one-step integration. We neglect, changes in power *Pk*(t) for this step. In this case, the formula (8) is exposed stepwise in a solution, however, dividing the time interval into sufficiently small steps,any impact can be represented as the sum of a large number of slightly different from each other steps.

To illustrate the usefulness of this approach to the calculation of the dynamics of systems under the influence of forces that vary not stepped law, consider the dynamics of a system with one degree of freedom under the force varies harmonically. The solution of equation (7) for the harmonic effects is as follows:

$$G(t) = e^{-ht}\left\{\begin{aligned}&\left[G(0) - \frac{F_0}{m}\frac{(\sigma^2-\omega^2)}{(\sigma^2-\omega^2)^2 + 4h^2f^2}\right]\cos(\sigma t) + \\ &+\left[\frac{\dot{G}(0) + hG(0)}{\sigma} - \frac{F_o}{m\sigma}\frac{h(\sigma^2-\omega^2)}{(\sigma^2-\omega^2) + 4h^2\omega^2}\right]\sin(\sigma t)\end{aligned}\right\} + \\ + \frac{F_o}{m\left[(\sigma^2-\omega^2)^2 + 4h^2\omega^2\right]}\left[(\sigma^2-\omega^2)\cos(\omega t) + 2h\omega\sin(\omega t)\right] \quad (9)$$

Figure 2 shows graphs of oscillations built with step τ = 0,2 *s*. In Figure 3, the same process is built step τ = 0,01 *s*. As initial conditions, the following values were taken: *G* (0) = 5 m, $\dot{G}$ (0) = 50 m / s.

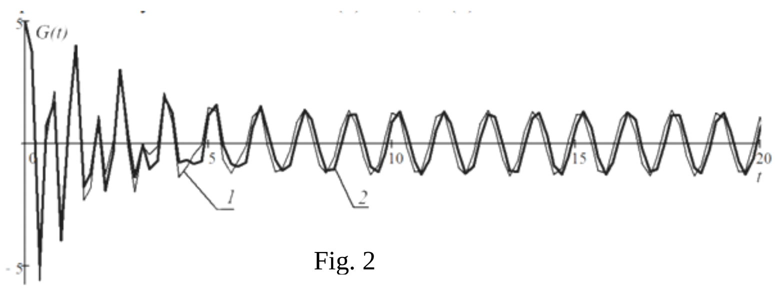

Fig. 2

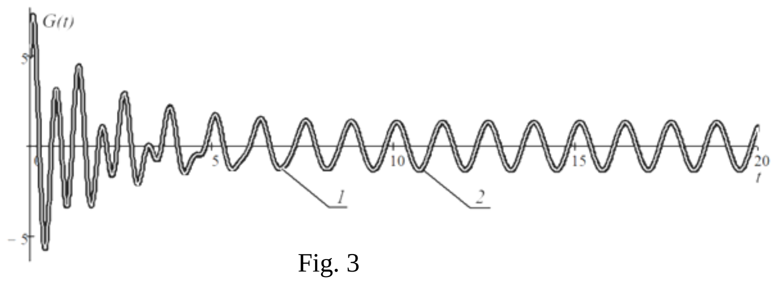

Fig. 3

According to Figure 2 and 6 show that the time step τ = 0.01s results are the same.

To summarize, we can conclude that for a large number of supports solution for the problem of the vibration of elastic systems with an infinite number of degrees of freedom can be made, representing the beam free. This approach is in contrast to the classical one and allows without making cumbersome expressions to determine the frequency equation and the shape functions to get a reasonably accurate solution, thus to consider the nonlinear elastic ties, to calculate the dynamics of the system under the influence of arbitrary power, determined at each iteration depending on the behavior of the elastic system.

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UDC 723.01

THE CHURCH OF THE INTERCESSION OF THE BLESSED VIRGIN MARY

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Polotsk as one of the oldest towns of Belaya Rus, is known for its numerous monuments of Orthodox architecture. Sophia Cathedral of the XI century (extant in reconstructed form), complex of the Saviour-Euphrossinia Convent with buildings of different time periods. But there were buildings on the Polotsk land of temples, information about which you will not find in any books on architecture, not in publications in archeology. These were religious buildings of later, not of the medieval period. During the Soviet period, because of their large number, they were not give the status of architectural monuments and were totally to the extent possible destroyed. The result of this policy was complete destruction of the architectural heritage of spiritual one.

In Polotsk victims of the post-revolutionary period were not only people, but also churches: Cathedral of St. Nicholas, St. John the Theologian convent in Pardaugava, the church of the Archangel Michael in Zapolote, the Church of St. George in Ekimani and Church of the Intercession.

Polotsk Church of the Intercession of the Blessed Virgin Mary was built in 1781, or to be more exact, rebuilt from an old Polotsk Church of the Epiphany monastery. To some extent this was a continuation of the tradition… in the ancient city of necropolis, were in this place since the time of the Polotsk Principality. Traces of this necropolis were discovered by archaeologists during the construction of fiberglass.

In 1804, by order of Emperor Alexander 1st, who visited Polotsk in July 1802, the Church of the Intercession Cathedral, that is the city's main church, actually started to performs the role of the cathedral church.

After the restoration of Polotsk diocese and the Jesuit church of St. Pereosvyascheniya, Jesuit Church of St. Stephen's Cathedral Church of St. Nicholas of Myra, in 1833 the Church of the intercession was converted into a parish. 57 years later after moving to a new location the Church building fell into complete decay, and was closed. Instead, in 1838, a new Church was built in a former Franciscan monastery. The Church received the name of Novo-Pokrovskaya Church and was located in the Nizhnepokrovskaya street [1]. However, next year the brick building of the former Church got covered with cracks due to settling of the foundation, and the Church was closed. In 1867, was drafted to the extension of the bell tower and the alteration of the wooden Church of the intercession, which was closed with 38 years. Perhaps around this time (in late 60 – early 70's) it was renovated and reopened.

1900 illuminates the site of a wooden building that housed the Church. The fire destroyed the temple and 100 yards. However, icons and jewelry were been saved, and the congregation moved them to St. Sophia's Cathedral.

In 1903, the decree of Polotsk Orthodox Consistory about the construction of the new Church [2].

In the 30-ies, like many other churches, the Church was closed, the priests were subjected to repression and persecution. After the liberation of the town from the Germans, the building was desolated for the while, and then it was the candy factory (Fig.1). In 1960 the factory was burnt in a fire.

Fig. 1. The Church of the Intercession at the time of Polotsk occupation by Nazi invaders.
Winter 1941 – 1943