



QO‘QON UNIVERSITETI XABARNOMASI

ILMIY-ELEKTRON JURNALI
5-SON

**KOKAND UNIVERSITY
HERALD** | **2022**
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**QO‘QON
UNIVERSITETI
XABARNOMASI
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**ВЕСТНИК
КОКАНДСКОГО
УНИВЕРСИТЕТ
ВЫПУСК 5**

5/2022

QO'QON UNIVERSITETI

XABARNOMASI

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TRANSVERSAL IZOTROP JISM UCHUN IKKI O'LCHOVLI TERMOELASTIK BOG'LIQ MASALANI SONLI MODELASHTIRISH VA UNING DASTURIY TA'MINOTI

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MAQOLA HAQIDA	АННОТАЦИЯ
<p>Qabul qilindi: 24-dekabr 2022-yil Tasdiqlandi: 26-dekabr 2022-yil Jurnal soni: 5 Maqola raqami: 23 DOI: https://doi.org/10.54613/ku.v5i5.228</p>	<p>Ushbu maqolada transversal izotrop jism uchun ikki o'lchovli termoelastik bog'liq masalani sonli modellashtirish va uning dasturiy ta'minoti mazmuni bayon etilgan hamda tajribasinoz asosida olingan natijalarning samaradorlik darajasi anqlangan.</p>
<p>KALIT SO'ZLAR/ Ключевые слова/ Keywords</p> <p>Kompozision, konstruksiya, termoelastik, issiqlik o'tkazuvchanlik, deformatsiya, matematik model, dinamik, tenzor, kvadrat plastina.</p>	

Kirish. Ayni damda ko'pgina ishlab chiqarish sohaslarida kompozision materiallardan foydalanish zamon talabiga aylanib bormoqda. Konstruksiya va ular elementlarining termoelastik holatlarini matematik modellashtirish va sonli yechimlarini aniqlash dolzarb muammolaridandir. Kompozitsion materiallarni matematik modellashtirishda material bir jinsli va anizotrop material bilan almashtiriladi. Termoelastik masalalar qo'yilishiga qarab bog'liq va bog'liq bo'lmagan chegaraviy masalalarga ajraladi. Umumiy holda bog'liq masalada qattiq jismning harakat tenglamalari issiqlik o'tkazuvchanlik tenglamalari bilan birgalikda qaraladi. Bog'liq

masalalarni matematik modellarini va ularni sonli yechish algoritmlarini o'rganish, olingan sonli natijalarga asosan yangidan-yangi kompozision materiallarni taklif etish samolyotsozlik, raketsozlik, mashinasozlik, avtomobilsozlik, qurilish, medisina va ishlab chiqarishning ko'plab boshqa sohaslarida katta foyda keltiradi.

Tadqiqot metodologiyasi. Quyida transversal izotrop jismlar uchun termoelastik masalaning dinamik bog'liqligining matematik modeli va bu modelni sonli yechish qaraladi. Transversal izotrop jismlar uchun bog'liq dinamik masalaning ikki o'lchovli holda harakat tenglamalari quyidagicha:

$$C_{1111} \frac{\partial^2 u}{\partial x^2} + (C_{1122} + C_{1212}) \frac{\partial^2 v}{\partial x \partial y} + C_{1212} \frac{\partial^2 u}{\partial y^2} - \beta_{11} \frac{\partial T}{\partial x} + X_1 = \rho \frac{\partial^2 u}{\partial t^2} \quad (1)$$

$$C_{1212} \frac{\partial^2 v}{\partial x^2} + (C_{1212} + C_{2211}) \frac{\partial^2 u}{\partial x \partial y} + C_{2222} \frac{\partial^2 v}{\partial y^2} - \beta_{22} \frac{\partial T}{\partial y} + X_2 = \rho \frac{\partial^2 v}{\partial t^2} \quad (2)$$

Transversal izotrop jismlar uchun issiqlik tarqalishi tenglamasi:

$$\lambda_{11} \frac{\partial^2 T}{\partial x^2} + \lambda_{22} \frac{\partial^2 T}{\partial y^2} - c_e \frac{\partial T}{\partial t} - T \left(\beta_{11} \frac{\partial^2 u}{\partial x \partial t} + \beta_{22} \frac{\partial^2 v}{\partial y \partial t} \right) = 0 \quad (3)$$

(3) bu tenglama uchun boshlang'ich shartlar quyidagicha

$$u(x, y, t) \Big|_{t=0} = \varphi_1, \quad \frac{\partial u}{\partial t} \Big|_{t=0} = \psi_1, \quad v(x, y, t) \Big|_{t=0} = \varphi_2, \quad \frac{\partial v}{\partial t} \Big|_{t=0} = \psi_2, \quad T(x, y, t) \Big|_{t=0} = T_0 \quad (4)$$

va chegaraviy shartlar quyidagicha bo'ladi

$$u(x, y, t) \Big|_{x=0} = u_0; \quad u(x, y, t) \Big|_{x=\ell_1} = \bar{u}_0; \quad u(x, y, t) \Big|_{y=0} = u'_0; \quad u(x, y, t) \Big|_{y=\ell_2} = \bar{u}'_0$$

$$v(x, y, t)|_{x=0} = v_0; \quad v(x, y, t)|_{x=\ell_1} = \bar{v}_0; \quad v(x, y, t)|_{y=0} = v'_0; \quad v(x, y, t)|_{y=\ell_2} = \bar{v}'_0 \quad (5)$$

$$T(x, y, t)|_{x=0} = T_1(t); \quad T(x, y, t)|_{x=\ell_1} = T_2(t); \quad T(x, y, t)|_{y=0} = T'_1(t); \quad T(x, y, t)|_{y=\ell_2} = T'_2(t)$$

Bu yerda: σ_{ij} - kuchlar tenzori, X_i - xajmiy kuchlar, C_{ijkl} - jismni xarakterlovchi parametrlari, ε_{ij} - deformatsiya tenzori, β_{ij} - xajmiy issiqlik kengayishi koeffitsienti, δ_{ij} - kroner simvoli, bunda;

$$\delta_{ij} = \begin{cases} 1, & i=j \\ 0, & i \neq j \end{cases} \quad C_\varepsilon - \text{doimiy temperaturada issiqlik sig'im} \quad \beta_{ij} - \text{issiqlik kengayish tenzori,}$$

λ_{ij} - issiqlik quyumi tenzori va Koshi munosabati, \dot{O} - temperatura, ρ - zichligi, $t \geq 0, \quad 0 \leq x \leq l_1, \quad 0 \leq y \leq l_2$ da 3ta: $x = ih_1, (i=0, k), y = jh_2 (j=0, k), t = n\tau \quad (n=0, 1, 2, \dots)$ prallel to'g'ri chiziqlar oilasini qurib (1)-(3) tenglamalarni turli munosabatlarda ularning xosilalariga almashtiramiz.

$$C_{1111} \frac{u_{i+1,j}^n - 2u_{i,j}^n + u_{i-1,j}^n}{h_1^2} + (C_{1122} + C_{1212}) \frac{v_{i+1,j+1}^n - v_{i-1,j+1}^n - v_{i+1,j-1}^n + v_{i-1,j-1}^n}{4h_1h_2} +$$

$$+ C_{1212} \frac{u_{i,j+1}^n - 2u_{i,j}^n + u_{i,j-1}^n}{h_2^2} - \beta_{11} \frac{T_{i+1,j}^n - T_{i-1,j}^n}{2h_1} = \rho \frac{u_{i,j}^{n+1} - 2u_{i,j}^n + u_{i,j}^{n-1}}{\tau^2} \quad (6)$$

$$C_{2222} \frac{v_{i,j+1}^n + 2v_{i,j}^n + v_{i,j-1}^n}{h_2^2} + (C_{1212} + C_{2211}) \frac{u_{i+1,j+1}^n - u_{i-1,j+1}^n - u_{i+1,j-1}^n + u_{i-1,j-1}^n}{4h_1h_2} +$$

$$+ C_{1212} \frac{v_{i+1,j}^n - 2v_{i,j}^n + v_{i-1,j}^n}{h_1^2} - \beta_{22} \frac{T_{i,j-1}^n - T_{i,j+1}^n}{2h_2} = \rho \frac{v_{i,j}^{n+1} - 2v_{i,j}^n + v_{i,j}^{n-1}}{\tau^2} \quad (7)$$

$$\lambda_{11} \frac{T_{i+1,j}^n - 2T_{i,j}^n + T_{i-1,j}^n}{h_1^2} + \lambda_{22} \frac{T_{i,j+1}^n - 2T_{i,j}^n + T_{i,j-1}^n}{h_2^2} - c_\varepsilon \frac{T_{i,j}^{n+1} - T_{i,j}^n}{\tau} -$$

$$- T_0 (\beta_{11} \frac{u_{i+1,j}^{n+1} - u_{i-1,j}^{n+1} - u_{i+1,j}^{n-1} + u_{i-1,j}^{n-1}}{4h_1\tau} + \beta_{22} \frac{v_{i,j+1}^{n+1} - v_{i,j-1}^{n+1} - v_{i,j+1}^{n-1} + v_{i,j-1}^{n-1}}{4h_2\tau}) = 0 \quad (8)$$

Yuqoridagi (6)-(7) va (8) - tenglamalardan $u_{i,j}^{n+1}, v_{i,j}^{n+1}, T_{i,j}^{n+1}$ larni topamiz.

$$u_{i,j}^{n+1} = \frac{\tau^2}{\rho} (C_{1111} \frac{u_{i+1,j}^n - 2u_{i,j}^n + u_{i-1,j}^n}{h_1^2} + (C_{1122} + C_{1212}) \frac{v_{i+1,j+1}^n - v_{i-1,j+1}^n - v_{i+1,j-1}^n + v_{i-1,j-1}^n}{4h_1h_2} +$$

$$+ C_{1212} \frac{u_{i,j+1}^n - 2u_{i,j}^n + u_{i,j-1}^n}{h_2^2} - \beta_{11} \frac{T_{i+1,j}^n - T_{i-1,j}^n}{2h_1}) + 2u_{i,j}^n - u_{i,j}^{n-1} \quad (9)$$

$$v_{i,j}^{n+1} = \frac{\tau^2}{\rho} (C_{2222} \frac{v_{i,j+1}^n + 2v_{i,j}^n + v_{i,j-1}^n}{h_2^2} + (C_{1212} + C_{2211}) \frac{u_{i+1,j+1}^n - u_{i-1,j+1}^n - u_{i+1,j-1}^n + u_{i-1,j-1}^n}{4h_1h_2} +$$

$$+ C_{1212} \frac{v_{i+1,j}^n - 2v_{i,j}^n + v_{i-1,j}^n - \beta_{22} \frac{T_{i,j-1}^n - T_{i,j-1}^n}{2h_2}}{h_1^2}) + 2v_{i,j}^n - v_{i,j}^{n+1} \quad (10)$$

$$T_{i,j}^{n+1} = \frac{\tau}{c_\varepsilon} (\lambda_{11} \frac{T_{i+1,j}^n - 2T_{i,j}^n + T_{i-1,j}^n}{h_1^2} + \lambda_{22} \frac{T_{i,j+1}^n - 2T_{i,j}^n + T_{i,j-1}^n}{h_2^2} -$$

$$- T_0 (\beta_{11} \frac{u_{i+1,j}^{n+1} - u_{i-1,j}^{n+1} - u_{i+1,j}^{n-1} + u_{i-1,j}^{n-1}}{4h_1\tau} + \beta_{22} \frac{v_{i,j+1}^{n+1} - v_{i,j-1}^{n+1} - v_{i,j+1}^{n-1} + v_{i,j-1}^{n-1}}{4h_2\tau})) + T_{i,j}^n \quad (11)$$

(9)-(11) tenglamalar t^{n+1} qatlamda $u(x,y,t)$, $v(x,y,t)$, $T(x,y,t)$ funksiyalarning qiymatlarini topishga imkon beradi, agar oldingi 2 ta qatlamning qiymati ma'lum bo'lsa, 2 ta boshlang'ich qatlamlardagi ($n=0 \dots n=1$) boshlang'ich shartlardan $u(x,y,t)$ va $v(x,y,t)$ funksiyalarning qiymatini topamiz, $T(x,y,t)$ funksiyaning qiymatini esa 1-qatlamda (11) munosabatdagi aralash xosilani boshqa munosabatga almashtirish orqali topamiz.

$$u_{i,j}^1 = \frac{\tau^2}{\rho} (C_{1111} \frac{u_{i+1,j}^0 - 2u_{i,j}^0 + u_{i-1,j}^0}{h_1^2} + (C_{1122} + C_{1212}) \frac{v_{i+1,j+1}^0 - v_{i-1,j+1}^0 - v_{i+1,j-1}^0 + v_{i-1,j-1}^0}{4h_1h_2} +$$

$$+ C_{1212} \frac{u_{i,j+1}^0 - 2u_{i,j}^0 + u_{i,j-1}^0 - \beta_{11} \frac{T_{i+1,j}^0 - T_{i-1,j}^0}{2h_1}}{h_2^2}) + 2u_{i,j}^0 - u_{i,j}^{-1} \quad (12)$$

$$v_{i,j}^1 = \frac{\tau^2}{\rho} (C_{2222} \frac{v_{i,j+1}^0 + 2v_{i,j}^0 + v_{i,j-1}^0}{h_2^2} + (C_{1212} + C_{2211}) \frac{u_{i+1,j+1}^0 - u_{i-1,j+1}^0 - u_{i+1,j-1}^0 + u_{i-1,j-1}^0}{4h_1h_2} +$$

$$+ C_{1212} \frac{v_{i+1,j}^0 - 2v_{i,j}^0 + v_{i-1,j}^0 - \beta_{22} \frac{T_{i,j-1}^0 - T_{i,j-1}^0}{2h_2}}{h_1^2}) + 2v_{i,j}^0 - v_{i,j}^1 \quad (13)$$

$$T_{i,j}^1 = \frac{\tau}{c_\varepsilon} (\lambda_{11} \frac{T_{i+1,j}^0 - 2T_{i,j}^0 + T_{i-1,j}^0}{h_1^2} + \lambda_{22} \frac{T_{i,j+1}^0 - 2T_{i,j}^0 + T_{i,j-1}^0}{h_2^2} -$$

$$- T_0 (\beta_{11} \frac{u_{i+1,j}^1 - u_{i-1,j}^1 - u_{i+1,j}^{-1} + u_{i-1,j}^{-1}}{4h_1\tau} + \beta_{22} \frac{v_{i,j+1}^1 - v_{i,j-1}^1 - v_{i,j+1}^{-1} + v_{i,j-1}^{-1}}{4h_2\tau})) + T_{i,j}^0 \quad (14)$$

(6) tenglamani quyidagi ko'rinishda yozish mumkin:

$$a_i u_{i+1,j}^{n+1} + b_i u_{i,j}^{n+1} + c_i u_{i-1,j}^{n+1} = f_i \quad (15)$$

$$a_i = \frac{C_{1111}}{h_1^2}, \quad b_i = -2(\frac{C_{1111}}{h_1^2} + \frac{\rho}{\tau^2}), \quad c_i = \frac{C_{1111}}{h_1^2}$$

бунда

$$f_i = \rho \frac{-2u_{i,j}^n + u_{i,j}^{n-1}}{\tau^2} - (C_{1122} + C_{1212}) \frac{v_{i+1,j+1}^n - v_{i-1,j+1}^n - v_{i+1,j-1}^n + v_{i-1,j-1}^n}{4h_1h_2} -$$

$$- C_{1212} \frac{u_{i,j+1}^n - 2u_{i,j}^n + u_{i,j-1}^n}{h_2^2} + \beta_{11} \frac{T_{i+1,j}^n - T_{i-1,j}^n}{2h_1}$$

(7)- tenglamani quyidagi ko'rinishda yozish mumkin:

$$a_i v_{i+1,j}^{n+1} + b_i v_{i,j}^{n+1} + c_i v_{i-1,j}^{n+1} = f_i \quad (16)$$

$$a_i = \frac{C_{1111}}{h_1^2}, \quad b_i = -2(\frac{C_{1111}}{h_1^2} + \frac{\rho}{\tau^2}), \quad c_i = \frac{C_{1111}}{h_1^2}$$

Bunda

ва

$$f_i = \rho \frac{2v_{i,j}^n + v_{i,j}^{n-1}}{\tau^2} - (C_{1122} + C_{1212}) \frac{u_{i+1,j+1}^n - u_{i-1,j+1}^n - u_{i+1,j-1}^n + u_{i-1,j-1}^n}{4h_1h_2} +$$

$$+ C_{1212} \frac{v_{i+1,j}^n - 2v_{i,j}^n + v_{i-1,j}^n}{h_2^2} + \beta_{22} \frac{T_{i,j-1}^n - T_{i,j-1}^n}{2h_1}$$

(8)- tenglamani esa quyidagi ko'rinishda yozish mumkin:

$$a_i T_{i+1,j}^{n+1} + b_i T_{i,j}^{n+1} + c_i T_{i-1,j}^{n+1} = f_i \quad (17)$$

Bunda $a_i = \frac{\lambda_0}{h_1^2}$, $b_i = -\frac{2\lambda_0}{h_1^2} - \frac{C_\varepsilon}{\tau}$, $c_i = \frac{\lambda_0}{h_1^2}$ va

$$f_i = \lambda_{22} \frac{T_{i,j+1}^n - 2T_{i,j}^n + T_{i,j-1}^n}{h_2^2} - \lambda_{11} \frac{T_{i+1,j}^n - 2T_{i,j}^n + T_{i-1,j}^n}{h_1^2} - T_0 \left(\beta_{11} \frac{u_{i+1,j}^{n+1} - u_{i-1,j}^{n+1} - u_{i+1,j}^{n-1} + u_{i-1,j}^{n-1}}{4h_1\tau} + \right.$$

$$\left. + \beta_{22} \frac{v_{i,j+1}^{n+1} - v_{i,j-1}^{n+1} - v_{i,j+1}^{n-1} + v_{i,j-1}^{n-1}}{4h_2\tau} \right) - C_\varepsilon \frac{T_{i,j}^{n+1} - T_{i,j}^n}{\tau}$$

(15)-tenglamani $u(x, y, t)|_{x=\ell_1} = u_0$, $u(x, y, t)|_{x=\ell_1} = \bar{u}_0$, chegaraviy shartlar bilan, (16)-tenglamani $v(x, y, t)|_{x=0} = v_0$, $v(x, y, t)|_{x=\ell_1} = \bar{v}_0$ chegaraviy shartlar bilan (17)-tenglamani $T(x, y, t)|_{x=0} = T_1(t)$, $T(x, y, t)|_{x=0} = T_2(t)$ chegaraviy shartlar bilan birga, to'rlar metodi bilan yechilgan.

Tahlil va natijalar. Transversal izotrop jism uchun ikki o'lchovli termoelastik bog'liq masalani sonli yechishning dasturiy ta'minotini yaratishda C++ Builder 6 dasturlash tilidan foydalanilgan.



1-rasm. Dasturning tuzilish strukturasi

Kiritiluvchi konstantalar: Lyambda11, Lyambda22 - Issiqlik quyumi tenzorlari; Beta11, Beta22 - Birinchi va ikkinchi harakat tenglamasidagi hajmiy issiqlik kengayishi koeffitsientlari; C1111, C1122, C1212, C2222 - jismni xarakterlovchi parametrlari; Ro - Jism zichligi; Ce - Doimiy temperaturadagi issiqlik sig'imi; T0 -Jismga qo'yiladigan temperaturasi; h1 - X o'qi bo'yicha tugun nuqtalar orasidagi balandlik.h2 - Y o'qi bo'yicha tugun nuqtalar orasidagi balandlik; tao - Qalamlarning vaqt oralig'i; n - Qadamlar soni.

Lyambda11 - 0.5, Lyambda22 - 0.3, Beta11 - 0.05, Beta22 - 0.09, C1111 - 0.75, C1122 - 0.91, C1212 - 0.9, C2222 - 0.89, Ro - 1.1, Ce - 3.4, T0 - 5, h1 - 0.1, h2 - 0.1, tao - 0.01, n - 10.

U, V, T larning ikki o'lchovli kvadrat plastinadagi o'zgarish xolatini quyidagicha ko'rishimiz mumkin. Bunda kiritilgan o'zgarishlar asosida quyidagi natijalarni olamiz:

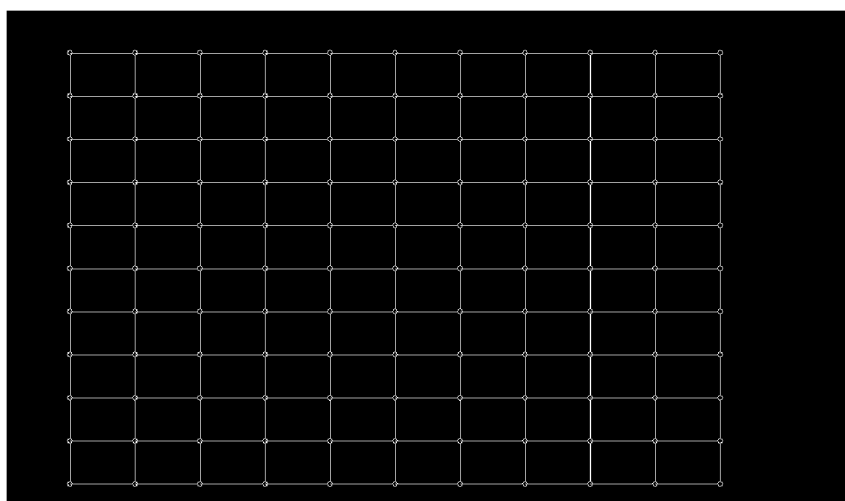
ANIQ YECHIM										
0	0	0	0	0	0	0	0	0	0	0
0	0,101126366	0,185684113	0,252046359	0,293794033	0,306812010	0,289827282	0,244466566	0,175102028	0,089235882	0
0	0,185716123	0,347549633	0,475361001	0,556720139	0,583638414	0,553483529	0,469170091	0,338856295	0,176014518	0
0	0,252108725	0,475393673	0,652158397	0,765182110	0,803379764	0,763016067	0,648003933	0,469500570	0,245683689	0
0	0,293854492	0,556752805	0,765182107	0,898817978	0,944559730	0,897934346	0,763467060	0,554216581	0,291357754	0
0	0,306870364	0,583671075	0,803379761	0,944559730	0,993372560	0,945044918	0,804268499	0,584719229	0,308571029	0
0	0,289883532	0,553516185	0,763016064	0,897934346	0,945044918	0,899740908	0,766418336	0,558025705	0,295640259	0
0	0,244554278	0,469236937	0,648038125	0,763501255	0,804302694	0,766452530	0,653617883	0,476747171	0,253830760	0
0	0,175317995	0,339074559	0,469689119	0,554406119	0,584908540	0,558213598	0,476897556	0,348830372	0,187227178	0
0	0,088738177	0,175702262	0,245366322	0,291036899	0,308247329	0,295314697	0,253503743	0,186880572	0,102176276	0
0	0	0	0	0	0	0	0	0	0	0

2-rasm. ANIQ YECHIM ning jadvaldagi ko'rinishi

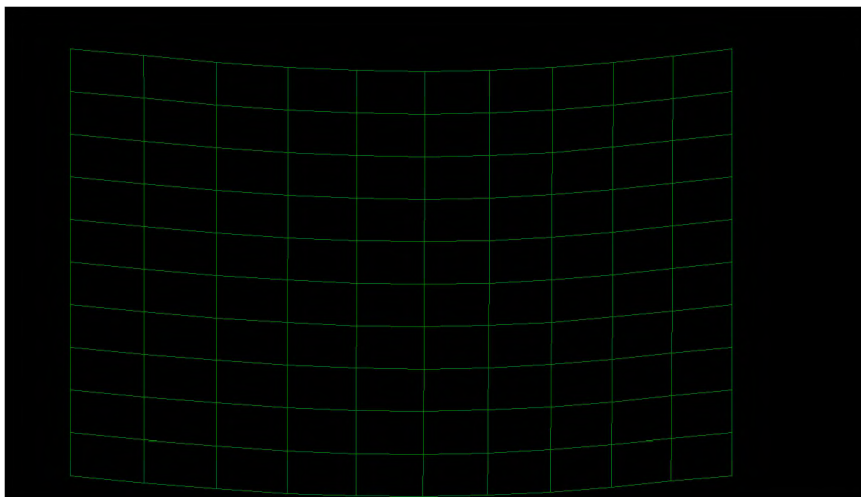
TAQRIBIY YECHIM										
0	0	0	0	0	0	0	0	0	0	0
0	0,105549970	0,188964923	0,253809616	0,293853265	0,305197493	0,286732940	0,240245674	0,170251471	0,083279559	0
0	0,188685799	0,349034689	0,475102889	0,554717880	0,580094652	0,548751650	0,463753731	0,333382823	0,170400800	0
0	0,253491026	0,475047234	0,650036831	0,761460485	0,798422663	0,757308887	0,642139591	0,464172251	0,240747894	0
0	0,293544309	0,554667643	0,761468760	0,893806578	0,938740337	0,891876030	0,757796443	0,549611962	0,287572033	0
0	0,304898947	0,580054542	0,798444389	0,938755246	0,987266580	0,939234536	0,799356105	0,581312559	0,306275057	0
0	0,286437936	0,548718727	0,757341270	0,891904370	0,939249425	0,894746628	0,762747868	0,556167422	0,295027770	0
0	0,239960051	0,463717276	0,642171625	0,757828238	0,799377211	0,762755530	0,651544417	0,476628994	0,254928568	0
0	0,169322758	0,332610087	0,463427334	0,548868133	0,580558519	0,555399514	0,475870870	0,349754743	0,189691914	0
0	0,084483256	0,171263843	0,241609536	0,288427854	0,307122398	0,295865076	0,255776242	0,190787565	0,106473675	0
0	0	0	0	0	0	0	0	0	0	0

3-rasm. TAQRIBIY YECHIM ning jadvaldagi ko'rinishi

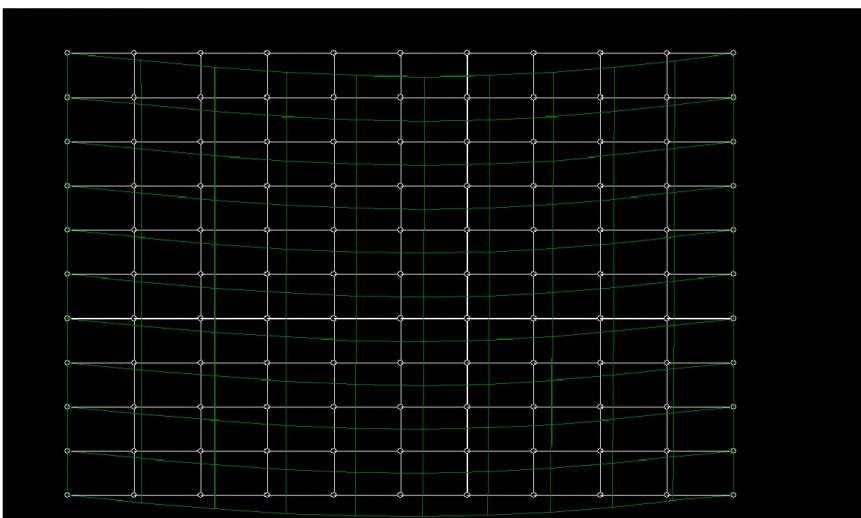
2, 3-raslarda keltirilgan natijalar asosida quyidagi grafik ko'rinishdagi natijalarni olamiz.



4-rasm. Kvadrat plastinaning dastlabki holati.



5-rasm. Kvadrat plastinaning U,V bo'yicha siljish holati.



6-rasm. Kvadrat plastinani temperatura ta'sir qilgandagi holati bilan solishtirish.

Xulosa. Xulosa qilib aytganda, amaliyotda uchraydigan ko'plab masalalarni matematik modellari termoelastik yoki termoplastik bog'liq va bog'liq bo'lmagan masalalarni o'rganishga keltiriladi. Kelguci tadqiqot ishlarimiz va maqolalarimizda bog'liq masalalarga qo'shimcha

tashqi ta'sirlar orqali uning holatini o'zgarishini, ularni sonli yechish usullarini o'rganish va bu masalalarning dasturiy ta'minotini yaratish bilan davom ettiramiz.

Adabiyotlar ro'yxati:

1. Наҳди П.М. Соотношение между напряжениями и деформациями в пластичности и термопластичности. Сб. пер. Механика, 1962.-С.87-133.
2. Победря Б.Е. Численные методы в теории упругости и пластичности.-М.: МГУ, 1996. – 343 с.
3. Халджигитов А.А., Каландаров А.А., Абдураимов Д.Э. Численное решение динамической краевой задачи теории упругости для ортотропных тел // Инновацион ва замонавий ахборот технологияларини таълим, фан ва бошқарув соҳаларида қўллаш истиқболлари халқаро конференцияси материаллари 2020 йил 14-15 май, 548-551 бетлар.
4. Abduraimov D. TRANSVERSAL ISOTROPIC BODY FOR TWO-DIMENSIONAL THERMOELASTICS RELATED TO THE EXAMPLE OF THE MATHEMATICAL MODEL AND ITS INSTRUCTIONS //CENTRAL ASIAN JOURNAL OF EDUCATION AND COMPUTER SCIENCES (CAJEC). – 2022. – Т. 1. – №. 6. – С. 6-11.
5. Абдураимов Д. Э. Ў., Адилов А. Н., Турдиев А. П. Ў. АНИЗОТРОП ВА ИЗОТРОП ЖИСМЛАР УЧУН ТЕРМОЭЛАСТИК БОҒЛИҚ МАСАЛАНИНГ ИККИ ЎЛЧОВЛИ ҲОЛАТДАГИ МАТЕМАТИК МОДЕЛИ //Scientific progress. – 2021. – Т. 1. – №. 5. – С. 449-453.
6. Архангельский А.Я. С++ Builder 6. Справочное пособие. Книга 1. Язык С++. –М.: Бинوم-Пресс, 2002 г.-544 с.
7. Культин Н.Б. С++Builder в задачах и примерах.-СПб.: БХВ-Петербург, 2005.-336 с.

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