

539.3

, 2012.

9

"

Maple

ó
ó

$2a_1^{(1)}$ $2a_1^{(2)}$,

1.

$2a_2$

ó

h

()

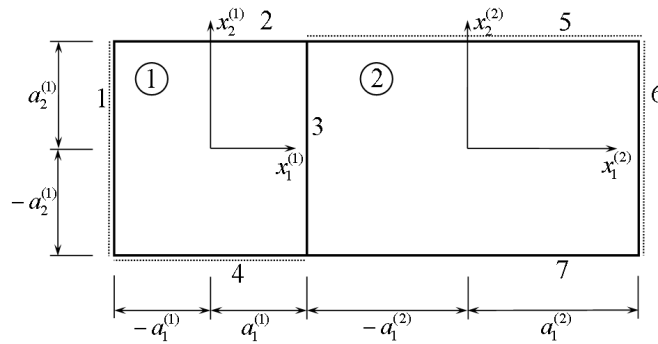
$Ox_1^k x_2^k x_3^k$, $k = 1, 2$,

Ox_3^k

Ox_1^k Ox_1^k , $k = 1, 2$,

$q^{(k)}(x_1, x_2)$, $k = 1, 2$,

ó



[6].

[1]. . . [7]

[3]

[2].

1, 4, 5, 6

2 i 7

3 ó

$$\begin{aligned}
\rightarrow & 1: w^{(1)}(-a_1^{(1)}, x_2^{(1)}) = 0; \quad M_{11}^{(1)}(-a_1^{(1)}, x_2^{(1)}) = 0; \\
\rightarrow & 4: w^{(1)}(x_1^{(1)}, -a_2^{(1)}) = 0; \quad M_{22}^{(1)}(x_1^{(1)}, -a_2^{(1)}) = 0; \\
\rightarrow & 2: M_{22}^{(1)}(x_1^{(1)}, a_2^{(1)}) = 0; \quad V_2(x_1^{(1)}, a_2^{(1)}) = 0; \\
\rightarrow & 5: w^{(2)}(x_1^{(2)}, a_2^{(2)}) = 0; \quad M_{22}^{(2)}(x_1^{(2)}, a_2^{(2)}) = 0; \\
\rightarrow & 6: w^{(2)}(a_1^{(2)}, x_2^{(2)}) = 0; \quad M_{11}^{(2)}(a_1^{(2)}, x_2^{(2)}) = 0; \\
\rightarrow & 7: M_{22}^{(2)}(x_1^{(2)}, -a_2^{(2)}) = 0; \quad V_2^{(2)}(x_1^{(2)}, -a_2^{(2)}) = 0;
\end{aligned} \tag{1}$$

$$\begin{aligned}
\rightarrow & 3: \\
w^{(1)}(a_1^{(1)}, x_2^{(1)}) &= w^{(2)}(-a_1^{(2)}, x_2^{(2)}), \quad M_{11}^{(1)}(a_1^{(1)}, x_2^{(1)}) = M_{11}^{(2)}(-a_1^{(2)}, x_2^{(2)}); \\
u_1^{(1)}(a_1^{(1)}, x_2^{(1)}) &= u_1^{(2)}(-a_1^{(2)}, x_2^{(2)}), \quad Q_1^{(1)}(a_1^{(1)}, x_2^{(1)}) = Q_1^{(2)}(-a_1^{(2)}, x_2^{(2)}).
\end{aligned} \tag{2}$$

(1), (2)

$$w^{(1)}(-a_1^{(1)}, x_2^{(1)}) = [W^{(1)}(-a_1^{(1)}, x_2^{(1)})]_{\mathbb{R}^{(1)}} \uparrow \{W_*^{(1)}(-a_1^{(1)}, x_2^{(1)})\} = 0,$$

$$M_{11}^{(1)}(-a_1^{(1)}, x_2^{(1)}) = [X_{11}^{(1)}(-a_1^{(1)}, x_2^{(1)})]_{\mathbb{R}^{(1)}} \uparrow \{X_{11*}^{(1)}(-a_1^{(1)}, x_2^{(1)})\} = 0,$$

$$M_{22}^{(1)}(x_1^{(1)}, a_2^{(1)}) = [X_{22}^{(1)}(x_1^{(1)}, a_2^{(1)})]_{\mathbb{R}^{(1)}} \uparrow \{X_{22*}^{(1)}(x_1^{(1)}, a_2^{(1)})\} = 0,$$

$$V_2^{(1)}(x_1^{(1)}, a_2^{(1)}) = [H_{22}^{(1)}(x_1^{(1)}, a_2^{(1)})]_{\mathbb{R}^{(1)}} \uparrow \{H_{22*}^{(1)}(x_1^{(1)}, a_2^{(1)})\} = 0,$$

$$w^{(2)}(x_1^{(2)}, a_2^{(2)}) = [W^{(2)}(x_1^{(2)}, a_2^{(2)})]_{\mathbb{R}^{(2)}} \uparrow \{W_*^{(2)}(x_1^{(2)}, a_2^{(2)})\} = 0,$$

$$M_{22}^{(2)}(x_1^{(2)}, a_2^{(2)}) = [X_{22}^{(2)}(x_1^{(2)}, a_2^{(2)})]_{\mathbb{R}^{(2)}} \uparrow \{X_{22*}^{(2)}(x_1^{(2)}, a_2^{(2)})\} = 0,$$

$$w^{(2)}(a_1^{(2)}, x_2^{(2)}) = [W^{(1)}(a_1^{(2)}, x_2^{(2)})]_{\mathbb{R}^{(1)}} \uparrow \{W_*^{(1)}(a_1^{(2)}, x_2^{(2)})\} = 0,$$

$$M_{11}^{(2)}(a_1^{(2)}, x_2^{(2)}) = [X_{11}^{(2)}(a_1^{(2)}, x_2^{(2)})]_{\mathbb{R}^{(2)}} \uparrow \{X_{11*}^{(2)}(a_1^{(2)}, x_2^{(2)})\} = 0,$$

$$M_{22}^{(2)}(x_1^{(2)}, -a_2^{(2)}) = [X_{22}^{(2)}(x_1^{(2)}, -a_2^{(2)})]_{\mathbb{R}^{(2)}} \uparrow \{X_{22*}^{(2)}(x_1^{(2)}, -a_2^{(2)})\} = 0,$$

$$V_2^{(2)}(x_1^{(2)}, -a_2^{(2)}) = [H_{22}^{(1)}(x_1^{(2)}, -a_2^{(2)})]_{\mathbb{R}^{(1)}} \uparrow \{H_{22*}^{(2)}(x_1^{(2)}, -a_2^{(2)})\} = 0,$$

$$w^{(1)}(x_1^{(2)}, -a_2^{(1)}) = [W^{(1)}(x_1^{(1)}, -a_2^{(1)})]_{\mathbb{R}^{(1)}} \uparrow \{W_*^{(1)}(x_1^{(1)}, -a_2^{(1)})\} = 0,$$

$$M_{22}^{(1)}(x_1^{(1)}, -a_2^{(1)}) = [X_{22}^{(1)}(x_1^{(1)}, -a_2^{(1)})] \{R^{(1)}\} + \{X_{22*}^{(1)}(x_1^{(1)}, -a_2^{(1)})\} = 0. \quad (3)$$

$$Z(x_1, x_2) = [Z] \{R\} + Z_*(x_1, x_2). \quad (4)$$

$$Z^{(1)} \Big|_3 (a_1^{(1)}, x_2^{(1)}) = Z^{(2)} \Big|_3 (-a_1^{(2)}, x_2^{(2)}). \quad (5)$$

$\{R\}$

$$\{R\} = \left\{ \begin{matrix} \{R^{(1)}\} \\ \{R^{(2)}\} \end{matrix} \right\}^T, \quad (6)$$

T

$$[Z^{(1)}(a_1^{(1)}, x_2^{(1)})] \{R^{(1)}\} + \{Z_*^{(1)}(a_1^{(1)}, x_2^{(1)})\} = [Z^{(2)}(-a_1^{(2)}, x_2^{(2)})] \{R^{(2)}\} + \{Z_*^{(2)}(-a_1^{(2)}, x_2^{(2)})\}. \quad (7)$$

$$[[Z^{(1)}(a_1^{(1)}, x_2^{(1)})] [-Z^{(2)}(-a_1^{(2)}, x_2^{(2)})]] \left\{ \begin{matrix} \{R^{(1)}\} \\ \{R^{(2)}\} \end{matrix} \right\} + \left\{ \begin{matrix} \{Z_*^{(1)}(a_1^{(1)}, x_2^{(1)})\} \\ \{Z_*^{(2)}(-a_1^{(2)}, x_2^{(2)})\} \end{matrix} \right\} = 0 \quad (8)$$

$$Z(x_2) \Big|_3 = [[Z^{(1)}(a_1^{(1)}, x_2^{(1)})] [-Z^{(2)}(-a_1^{(2)}, x_2^{(2)})]], \quad \{R\} = \left\{ \begin{matrix} \{R^{(1)}\} \\ \{R^{(2)}\} \end{matrix} \right\},$$

$$Z_*(x_2) \Big|_3 = \left\{ \begin{matrix} \{Z_*^{(1)}(a_1^{(1)}, x_2^{(1)})\} \\ \{Z_*^{(2)}(-a_1^{(2)}, x_2^{(2)})\} \end{matrix} \right\}. \quad (9)$$

K

$$(Z_*^{(1)}(x_1, x_2))_K = Z_{*p}^{(1)}(x_1, x_2). \quad (10)$$

$$[Z^{(1)}(x_1, x_2)]_K \{R^{(1)}\} + \{Z_*^{(1)}(x_1, x_2)\}_K = \{Z_{*p}^{(1)}(x_1, x_2)\}_K. \quad (11)$$

(9).

$$[Z(x_1, x_2)]_K = [[Z(x_1, x_2)]_K] [-O(x_1, x_2)]_K. \quad (12)$$

$$[M], \quad \{P\}$$

$$[M] \{R\} + \{P\} = 0. \quad (13)$$

(. 1),

$$2a_1^{(1)} = 4m, 2a_2^{(1)} = 4m, 2a_1^{(2)} = 6m, 2a_2^{(2)} = 4m$$

$$h = 0.2m$$

$$q^{(1)} = 100k N/m^2,$$

$$q^{(2)} = 200k N/m^2.$$

$$15, E_b = 2.3 \cdot 10^4 MN/m^2,$$

$$v_b = 0.2,$$

$$E_s = 2 \cdot 10^5 MN/m^2,$$

$S^{(1)} = 0.1\%$, $S^{(2)} = 0.5\%$.
 $0.03m$.

[3]:

$D_{11}^{(1)} = D_{22}^{(1)} = 1.6 \cdot 10^7 N/m^2$; $D_{11}^{(2)} = D_{22}^{(2)} = 1.7 \cdot 10^7 N/m^2$;
 $D_{12}^{(1)} = 3.2 \cdot 10^6 N/m^2$; $D_{12}^{(2)} = 3.4 \cdot 10^6 N/m^2$;
 $D_{66}^{(1)} = 6.4 \cdot 10^6 N/m^2$; $D_{66}^{(2)} = 6.8 \cdot 10^6 N/m^2$;

[5]

$K_0 = 5 \cdot 10^7 N/m^3$.

$x_2^{(k)} = \pm a_2^{(k)}$,

[2]:

$$x_{ij}^{(k)} = \frac{k^* (x_{2j}^{(k)} - x_{1j}^{(k)})}{K_* + 1} + x_{1j}^{(k)}, \tag{14}$$

K_* ó

k^* ó

$a_j, j=1,2$; $x_{ij}^{(k)}$ ó

9.4
2).

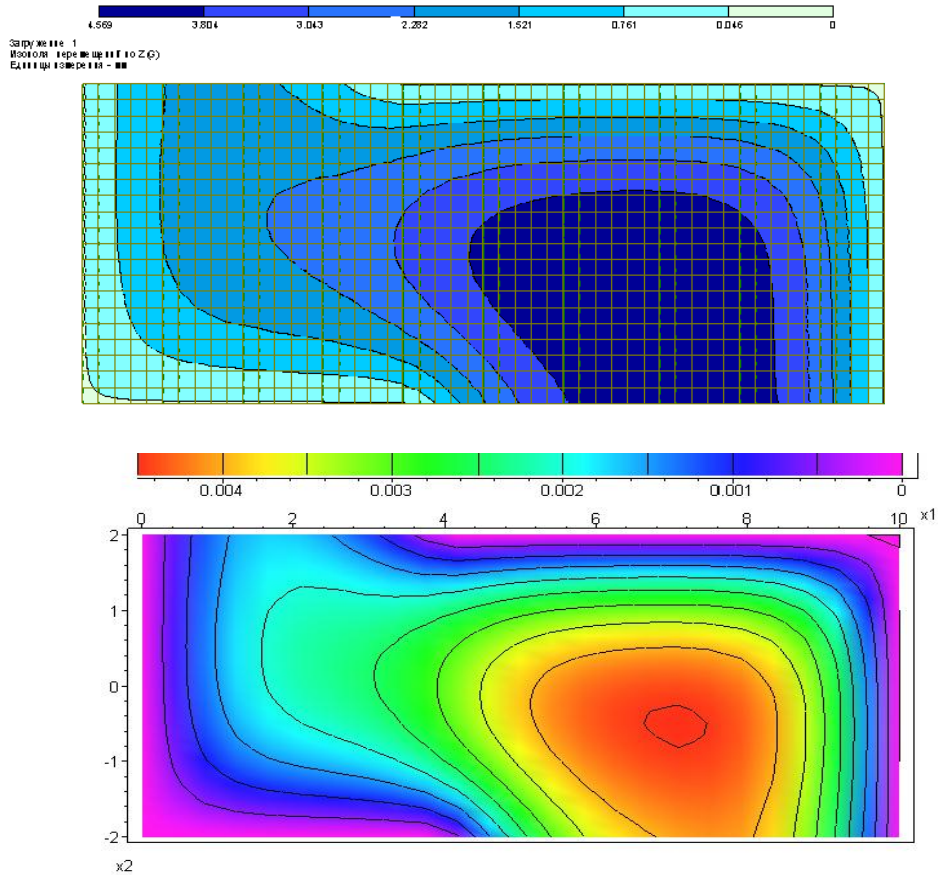
2),

Maple

28

1071

1000



x_2	W(1) ()	U1(1) ()	U2(1) ()	W(1) ()	U1(1) ()	U2(1) ()
-2	0.0000E+00	-3.770E-14	-3.680E-04	0.0000E+00	-7.147E-05	-7.147E-05
-1.8	7.2637E-04	-5.585E-05	-3.536E-04	6.5672E-04	-9.031E-05	-9.031E-05
-1.6	1.3970E-03	-1.041E-04	-3.132E-04	1.2195E-03	-9.861E-05	-9.861E-05
-1.4	1.9667E-03	-1.377E-04	-2.541E-04	1.6988E-03	-1.005E-04	-1.005E-04
-1.2	2.4081E-03	-1.528E-04	-1.868E-04	2.1012E-03	-9.998E-05	-9.998E-05
-1	2.7154E-03	-1.498E-04	-1.218E-04	2.4310E-03	-9.848E-05	-9.848E-05
-0.8	2.9028E-03	-1.330E-04	-6.794E-05	2.6926E-03	-9.659E-05	-9.659E-05
-0.6	2.9979E-03	-1.092E-04	-2.993E-05	2.8907E-03	-9.448E-05	-9.448E-05
-0.4	3.0334E-03	-8.574E-05	-7.987E-06	3.0293E-03	-9.215E-05	-9.215E-05
-0.2	3.0380E-03	-6.843E-05	1.858E-06	3.1115E-03	-8.941E-05	-8.941E-05
0	3.0296E-03	-6.036E-05	6.259E-06	3.1389E-03	-8.605E-05	-8.605E-05
0.2	3.0116E-03	-6.123E-05	1.263E-05	3.1115E-03	-8.174E-05	-8.174E-05
0.4	2.9735E-03	-6.787E-05	2.720E-05	3.0280E-03	-7.616E-05	-7.616E-05
0.6	2.8948E-03	-7.523E-05	5.359E-05	2.8854E-03	-6.894E-05	-6.894E-05
0.8	2.7510E-03	-7.781E-05	9.212E-05	2.6801E-03	-5.974E-05	-5.974E-05
1	2.5201E-03	-7.094E-05	1.400E-04	2.4081E-03	-4.828E-05	-4.828E-05
1.2	2.1883E-03	-5.179E-05	1.920E-04	2.0659E-03	-3.437E-05	-3.437E-05
1.4	1.7536E-03	-1.966E-05	2.417E-04	1.6518E-03	-1.810E-05	-1.810E-05
1.6	1.2272E-03	2.393E-05	2.828E-04	1.1667E-03	-6.777E-08	-6.777E-08
1.8	6.3200E-04	7.586E-05	3.097E-04	6.1397E-04	1.768E-05	1.768E-05
2	0.0000E+00	1.320E-04	3.191E-04	0.0000E+00	3.218E-05	3.218E-05

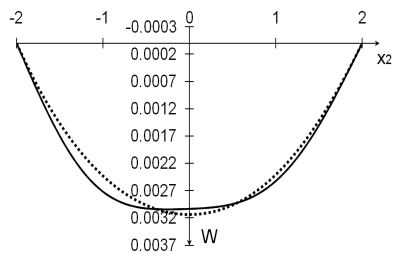
3-8 $x_1^{(1)} = 2$ ($x_1^{(2)} = -3$),

3 ó , 1 2 , (

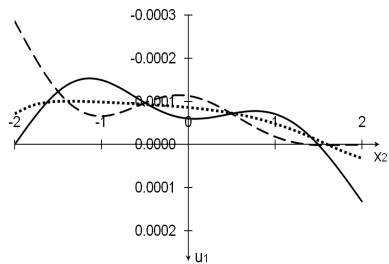
4,5 ó u_1 u_2 ,

6-8 ó M_{11} , M_{22} M_{12} .

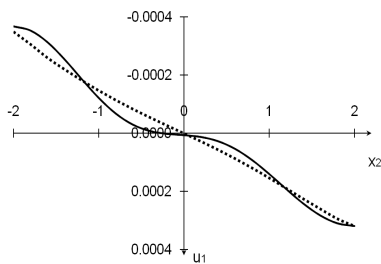
2.3% , ó 6.5% .



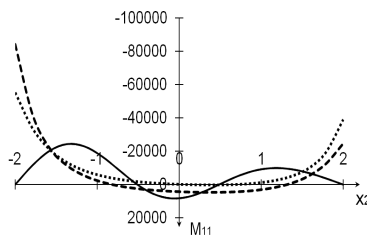
. 3



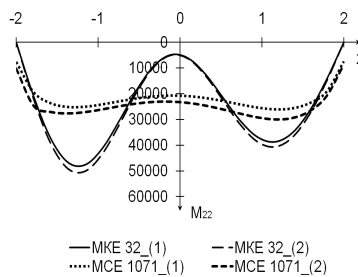
. 4



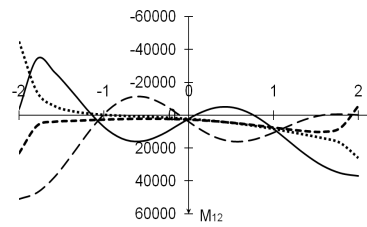
. 5



. 6



. 7



. 8

1. ... // ... 2006. ó .18, 7. ó .82 ó 92.
2. ... / ... //
3. § (... §) ... 2010. ó .27. ó .105 ó 109.
4. ... 1984. ó 480 .
5. .8. 2.05.08-85 / ... 2008. ó .1. ó .43 ó 50.
6. ... / ... 1985. ó 59 .
7. ... / ... 1978. ó 300 .
8. ... // ... 1,
9. ... 2004. ó .229 ó 232.