

Řešení soustavy rovnic $K \cdot r = f$

1. Za pomoci kalkulačky (Gaussova eliminace)

$$\begin{array}{ccc|c} 5 & 3 & -4 & 3 \\ -3 & -1 & 5 & 0 \\ 2 & 4 & 6 & 6 \end{array} \quad \begin{array}{l} *3 \setminus + \quad *2 \setminus + \\ *5 / \\ * -5 / \end{array}$$

$$\begin{array}{ccc|c} 5 & 3 & -4 & 3 \\ 0 & 4 & 13 & 9 \\ 0 & -14 & -38 & -24 \end{array} \quad \begin{array}{l} *14 \setminus + \\ *4 / \end{array}$$

$$\begin{array}{ccc|c} 5 & 3 & -4 & 3 \\ 0 & 4 & 13 & 9 \\ 0 & 0 & 30 & 30 \end{array}$$

Z poslední rovnice: $r_3 = 1$,
dosazeno do 2.: $r_2 = -1$,
dosazeno do 1.: $r_1 = 2$.

Kontrola: řešení r řeší původní soustavu rovnic

2. S využitím dostupných softwarů

a) Existuje interní funkce

b) Iterační metody, např. Jacobiho

Rozpis j -tého řádku:

$$[a_{ji} \dots a_{jj} \dots a_{jn}] * x_j = b_j$$

Vyjádření x_j :

$$x_j^{n+1} = 1/a_{jj} * [b_j - \sum_{i=1}^{j-1} a_{ji} x_i - \sum_{i=j+1}^n a_{ji} x_i]$$

podmínkou pozitivní definitnost a symetrie

Matlab (MathWorks)

Dostupný na <https://download.cvut.cz>

```
C:\Documents and Settings\leps\Dokumenty\doc\vyuka\NAK_2007\cviceni\iterations.m*
File Edit View Text Debug Breakpoints Web Window Help
[Icons] Stack: Base
1 %Jacobi
2
3 - A = [1 -1 0;-1 2 -1;0 -1 2]
4 - b = [1;0;0]
5
6 % spravne reseni
7 - r =A\b
8
9 - D_vect = diag(A);
10 - D_inv = 1./D_vect;
11
12 - D_l = diag(D_inv);%diagonal
13 - E = -tril(A,-1);%lower
14 - F = -triu(A,1);%upper
15
16 - x = [1;1;1]
17
18 - for c=1:100
19
20 %Jacobi
21 - t = D_l*(E+F)*x + D_l*b
22 - x=t;
23 %residuuum
24 - residuum = A*x - b;
25
26 - end
27
28
29
```


MathCAD

The screenshot displays the MathCAD software interface. The title bar reads "Mathcad - [rovnice.xmcd]". The menu bar includes "File", "Edit", "View", "Insert", "Format", "Tools", "Symbolics", "Window", and "Help". The toolbar contains various icons for file operations, editing, and mathematical functions. The status bar shows "Normal", "Arial", "10", and bold/italic/underline options. A search bar at the bottom left contains "My Site" and a "Go" button.

The main workspace contains the following mathematical expressions:

$$X := \begin{pmatrix} 1 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}$$
$$f := \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$$
$$r := X^{-1} \cdot f \rightarrow \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix}$$

Two floating tool palettes are visible:

- Matrix**: Contains icons for matrix creation ($\begin{bmatrix} \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \end{bmatrix}$), matrix inverse (X_n^{-1}), determinant ($|X|$), vector function ($f(t)$), matrix power (M^x), matrix transpose (M^T), matrix multiplication ($m..n$), matrix dot product ($\vec{a} \cdot \vec{b}$), matrix cross product ($\vec{a} \times \vec{b}$), and matrix summation ($\sum U$).
- Evaluati...**: Contains icons for assignment ($=$), definition ($:=$), and equality (\equiv), vector arrow (\rightarrow), vector arrow with function ($\vec{a} \rightarrow f x$), and vector arrow with function and superscript ($x f$, $x f y$, $x^f y$).

CAL (Computer Assisted Learning; University of Berkeley, FSv ČVUT)

Dostupný na <http://ksm.fsv.cvut.cz/CAL/cal.html>

```
C
C   RESENI NESYMETRICKE SOUSTAVY ALGEBRAICKYCH ROVNIC   A * X = B
C
LOAD A R=3 C=3           :   zadani matice A
  5   3  -4
-3  -1   5
  2   4   6
LOAD B R=3 C=1           :   zadani matice B
  3
  0
  6
TMULT A A ATA           :   priprava symetricke soustavy
TMULT A B X
SOLVE ATA X             :   reseni soustavy
PRINT X                 :   tisk vysledku
PAUSE
MULT A X ERR            :   vypocet chyby reseni
SUB ERR B
PRINT ERR               :   tisk chyby
PAUSE
QUIT                    :   navrat do DOSu
```

Další možnosti:

Mathematica

Maple

Vlastní program ...