**Практическая работа №4**

**Решение систем линейных алгебраических методом Гаусса**

**Задание:** Решить систему методом Гаусса:

1. Вручную по схеме единственного деления, получить решение с точностью 0,001. Определить невязки.

2. С помощью ЭВМ получить значения корней с точностью 0,000005

3. Вычислить погрешности результатов: полученных в результате ручных расчетов.

Таблица:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | | X1 | X2 | X3 | X4 | | 4,5 | 11,45 | -14,8 | 5,44 | | 20,06 | -13,6 | 20,25 | -3,51 | | -8 | 19,78 | -31,18 | 0,48 | | 13,66 | 25,4 | 7,24 | 4,22 | |  |

|  |
| --- |
| Св.ч. |
| 0,38 |
| 0,32 |
| 2,16 |
| 2,3 |

|  |  |
| --- | --- |
|  |  |
| 1 |  |

Умножим 1-ю строку на (-4.458). Добавим 2-ю строку к 1-й:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  | | --- | --- | --- | --- | | 0 | -64,642 | 86,225 | -27,76 | | 20,06 | -13,6 | 20,25 | -3,51 | | -8 | 19,78 | -31,18 | 0,48 | | 13,66 | 25,4 | 7,24 | 4,22 | |  | |  | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | |  | | --- | | -1,374 | | 0,32 | | 2,16 | | 2,3 | |  | |  |

Умножим 2-ю строку на (0.399). Добавим 3-ю строку к 2-й:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  | | --- | --- | --- | --- | | 0 | -64,642 | 86,225 | -27,76 | | 0 | 14,356 | -23,104 | -0,92 | | -8 | 19,78 | -31,18 | 0,48 | | 13,66 | 25,4 | 7,24 | 4,22 | |  | |  | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | |  | | --- | | -1,374 | | 2,288 | | 2,16 | | 2,3 | |  | |  |

Умножим 3-ю строку на (1.708). Добавим 4-ю строку к 3-й:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  | | --- | --- | --- | --- | | 0 | -64,642 | 86,225 | -27,76 | | 0 | 14,356 | -23,104 | -0,92 | | 0 | 59,174 | -46 | 5,04 | | 13,66 | 25,4 | 7,24 | 4,22 | |  | |  | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | |  | | --- | | -1,374 | | 2,288 | | 5,988 | | 2,3 | |  | |  |

Умножим 1-ю строку на (0.222). Добавим 2-ю строку к 1-й:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  | | --- | --- | --- | --- | | 0 | 0 | -3,954 | -7,085 | | 0 | 14,356 | -23,104 | -0,92 | | 0 | 59,174 | -46 | 5,04 | | 13,66 | 25,4 | 7,24 | 4,22 | |  | |  | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | |  | | --- | | 1,982 | | 2,288 | | 5,988 | | 2,3 | |  | |  |

Умножим 2-ю строку на (-4.122). Добавим 3-ю строку к 2-й:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  | | --- | --- | --- | --- | | 0 | 0 | -3,954 | -7,085 | | 0 | 0 | 49,232 | 8,831 | | 0 | 59,174 | -46 | 5,04 | | 13,66 | 25,4 | 7,24 | 4,22 | |  | |  | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | |  | | --- | | 1,982 | | -3,441 | | 5,988 | | 2,3 | |  | |  |

Умножим 1-ю строку на (12.45). Добавим 2-ю строку к 1-й:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  | | --- | --- | --- | --- | | 0 | 0 | 0 | -79,377 | | 0 | 0 | 49,232 | 8,831 | | 0 | 59,174 | -46 | 5,04 | | 13,66 | 25,4 | 7,24 | 4,22 | |  | |  | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | |  | | --- | | 21,24 | | -3,441 | | 5,988 | | 2,3 | |  | |  |

Теперь исходную систему можно записать так:  
x4 = 21.24/(-79.377)  
x3 = [-3.441 - (8.83x4)]/49.232  
x2 = [5.988 - ( - 46x3 + 5.04x4)]/59.174  
x1 = [2.3 - (25.4x2 + 7.24x3 + 4.22x4)]/13.66  
Из 1-й строки выражаем x4  
https://chart.googleapis.com/chart?cht=tx&chl=x_%7b4%7d%20=%20\frac%7b21.24%7d%7b-79.377%7d%20=%20-0.268  
Из 2-й строки выражаем x3  
https://chart.googleapis.com/chart?cht=tx&chl=x_%7b3%7d%20=%20\frac%7b-3.4410073517258%20-%208.83\cdot%20(-0.27)%7d%7b49.23%7d%20=%20\frac%7b-1.078%7d%7b49.23%7d%20=%20-0.0219  
Из 3-й строки выражаем x2  
https://chart.googleapis.com/chart?cht=tx&chl=x_%7b2%7d%20=%20\frac%7b5.9882%20-%20(-46)\cdot%20(-0.0219)%20-%205.04\cdot%20(-0.27)%7d%7b59.17%7d%20=%20\frac%7b6.33%7d%7b59.17%7d%20=%200.107  
Из 4-й строки выражаем x1  
https://chart.googleapis.com/chart?cht=tx&chl=x_%7b1%7d%20=%20\frac%7b2.3%20-%2025.4\cdot%200.11%20-%207.24\cdot%20(-0.0219)%20-%204.22\cdot%20(-0.27)%7d%7b13.66%7d%20=%20\frac%7b0.871%7d%7b13.66%7d%20=%200.0638

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