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| Федеральное государственное бюджетное  образовательное учреждение высшего образования «Новосибирский государственный технический университет» | | | |
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| Кафедра прикладной математики | | | |
|  | | | |
| Практическое задание № 2 | | | |
| по дисциплине «Численные методы» | | | |
| Место для ввода текста. | | | |
|  | | | |
|  | Группа | ПМ-81 |
| Бригада | 2 |
| Студенты | Басов денис |
|  | юрганов егор |
|  |  |
| Преподаватель | задорожный а.г. |
| Дата | 07.12.2020 |
|  | | | |
| Новосибирск | | | |

1. Цель

Разработать программы решения СЛАУ методами Якоби, Гаусса-Зейделя, блочной релаксации с хранением матрицы в диагональном формате. Исследовать сходимость методов для различных тестовых матриц и её зависимость от параметра релаксации. Изучить возможность оценки порядка числа обусловленности матрицы путем вычислительного эксперимента.

1. Анализ

Пусть дана система алгебраических уравнений:

Ax=F

Выбирается начальное приближение x(при отсутствии априорных данных для выбора приближения в качестве начального приближения можно выбрать нулевой вектор).

Итерационный процесс в методе Якоби с параметром релаксации выглядит следующим образом:

В методе Гаусса-Зейделя с параметром релаксации(другое название –метод релаксации) итерационный процесс описывается следующим образом:

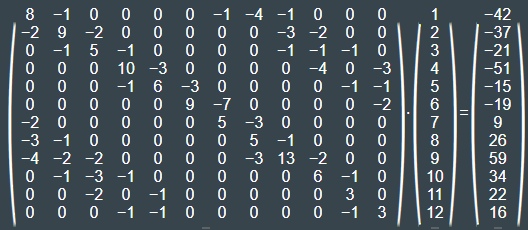
Условия выхода из итерационного процесса для рассмотренных методов:

Выход по относительной невязке

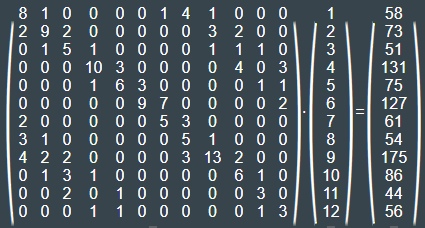
защита от зацикливания: k>maxiter, maxiter–максимальное количество итераций.

Проводим исследование реализованных методов на матрице с диагональным преобладанием. Матрица А

|  |
| --- |
| -92-10-k |
| -64 |
| -38 |
| -39 |
| 1 |
| -8 |
| 8 |
| 64 |
| 61 |
| 108 |



Провести аналогичные исследования на матрице с обрат-ным знаком внедиагональных элементов. Матрица В



1. Тестирование на матрице с диагональным преобладанием

Якоби

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| k | w | x | x\*-x | cond | x\* |
| 13730 | 0,1 | 0,99999999998074 | 0,00000000001926 | 31,795 | 1,00000000000000 |
|  |  | 1,99999999997667 | 0,00000000002333 |  | 2,00000000000000 |
|  |  | 2,99999999997521 | 0,00000000002479 |  | 3,00000000000000 |
|  |  | 3,99999999997455 | 0,00000000002545 |  | 4,00000000000000 |
|  |  | 4,99999999997576 | 0,00000000002424 |  | 5,00000000000000 |
|  |  | 5,99999999997777 | 0,00000000002223 |  | 6,00000000000000 |
|  |  | 6,99999999997922 | 0,00000000002078 |  | 7,00000000000000 |
|  |  | 7,99999999997887 | 0,00000000002113 |  | 8,00000000000000 |
|  |  | 8,99999999997749 | 0,00000000002251 |  | 9,00000000000000 |
|  |  | 9,99999999997481 | 0,00000000002519 |  | 10,00000000000000 |
|  |  | 10,99999999997490 | 0,00000000002510 |  | 11,00000000000000 |
|  |  | 11,99999999997460 | 0,00000000002540 |  | 12,00000000000000 |
| 6859 | 0,2 | 0,99999999998080 | 0,00000000001920 | 31,77 | 1,00000000000000 |
|  |  | 1,99999999997674 | 0,00000000002326 |  | 2,00000000000000 |
|  |  | 2,99999999997529 | 0,00000000002471 |  | 3,00000000000000 |
|  |  | 3,99999999997462 | 0,00000000002538 |  | 4,00000000000000 |
|  |  | 4,99999999997584 | 0,00000000002416 |  | 5,00000000000000 |
|  |  | 5,99999999997783 | 0,00000000002217 |  | 6,00000000000000 |
|  |  | 6,99999999997928 | 0,00000000002072 |  | 7,00000000000000 |
|  |  | 7,99999999997894 | 0,00000000002106 |  | 8,00000000000000 |
|  |  | 8,99999999997756 | 0,00000000002244 |  | 9,00000000000000 |
|  |  | 9,99999999997489 | 0,00000000002511 |  | 10,00000000000000 |
|  |  | 10,99999999997500 | 0,00000000002500 |  | 11,00000000000000 |
|  |  | 11,99999999997470 | 0,00000000002530 |  | 12,00000000000000 |
| 4569 | 0,3 | 0,99999999998088 | 0,00000000001912 | 31,6818 | 1,00000000000000 |
|  |  | 1,99999999997683 | 0,00000000002317 |  | 2,00000000000000 |
|  |  | 2,99999999997539 | 0,00000000002461 |  | 3,00000000000000 |
|  |  | 3,99999999997473 | 0,00000000002527 |  | 4,00000000000000 |
|  |  | 4,99999999997593 | 0,00000000002407 |  | 5,00000000000000 |
|  |  | 5,99999999997793 | 0,00000000002207 |  | 6,00000000000000 |
|  |  | 6,99999999997937 | 0,00000000002063 |  | 7,00000000000000 |
|  |  | 7,99999999997902 | 0,00000000002098 |  | 8,00000000000000 |
|  |  | 8,99999999997765 | 0,00000000002235 |  | 9,00000000000000 |
|  |  | 9,99999999997499 | 0,00000000002501 |  | 10,00000000000000 |
|  |  | 10,99999999997510 | 0,00000000002490 |  | 11,00000000000000 |
|  |  | 11,99999999997480 | 0,00000000002520 |  | 12,00000000000000 |
| 3234 | 0,4 | 0,99999999998096 | 0,00000000001904 | 31,6135 | 1,00000000000000 |
|  |  | 1,99999999997693 | 0,00000000002307 |  | 2,00000000000000 |
|  |  | 2,99999999997549 | 0,00000000002451 |  | 3,00000000000000 |
|  |  | 3,99999999997483 | 0,00000000002517 |  | 4,00000000000000 |
|  |  | 4,99999999997603 | 0,00000000002397 |  | 5,00000000000000 |
|  |  | 5,99999999997802 | 0,00000000002198 |  | 6,00000000000000 |
|  |  | 6,99999999997945 | 0,00000000002055 |  | 7,00000000000000 |
|  |  | 7,99999999997911 | 0,00000000002089 |  | 8,00000000000000 |
|  |  | 8,99999999997774 | 0,00000000002226 |  | 9,00000000000000 |
|  |  | 9,99999999997509 | 0,00000000002491 |  | 10,00000000000000 |
|  |  | 10,99999999997520 | 0,00000000002480 |  | 11,00000000000000 |
|  |  | 11,99999999997490 | 0,00000000002510 |  | 12,00000000000000 |
| 2736 | 0,5 | 0,99999999998085 | 0,00000000001915 | 31,5785 | 1,00000000000000 |
|  |  | 1,99999999997680 | 0,00000000002320 |  | 2,00000000000000 |
|  |  | 2,99999999997536 | 0,00000000002464 |  | 3,00000000000000 |
|  |  | 3,99999999997469 | 0,00000000002531 |  | 4,00000000000000 |
|  |  | 4,99999999997590 | 0,00000000002410 |  | 5,00000000000000 |
|  |  | 5,99999999997790 | 0,00000000002210 |  | 6,00000000000000 |
|  |  | 6,99999999997934 | 0,00000000002066 |  | 7,00000000000000 |
|  |  | 7,99999999997900 | 0,00000000002100 |  | 8,00000000000000 |
|  |  | 8,99999999997762 | 0,00000000002238 |  | 9,00000000000000 |
|  |  | 9,99999999997496 | 0,00000000002504 |  | 10,00000000000000 |
|  |  | 10,99999999997510 | 0,00000000002490 |  | 11,00000000000000 |
|  |  | 11,99999999997470 | 0,00000000002530 |  | 12,00000000000000 |
| 2279 | 0,6 | 0,99999999998111 | 0,00000000001889 | 31,4998 | 1,00000000000000 |
|  |  | 1,99999999997712 | 0,00000000002288 |  | 2,00000000000000 |
|  |  | 2,99999999997569 | 0,00000000002431 |  | 3,00000000000000 |
|  |  | 3,99999999997504 | 0,00000000002496 |  | 4,00000000000000 |
|  |  | 4,99999999997623 | 0,00000000002377 |  | 5,00000000000000 |
|  |  | 5,99999999997820 | 0,00000000002180 |  | 6,00000000000000 |
|  |  | 6,99999999997963 | 0,00000000002037 |  | 7,00000000000000 |
|  |  | 7,99999999997928 | 0,00000000002072 |  | 8,00000000000000 |
|  |  | 8,99999999997793 | 0,00000000002207 |  | 9,00000000000000 |
|  |  | 9,99999999997530 | 0,00000000002470 |  | 10,00000000000000 |
|  |  | 10,99999999997540 | 0,00000000002460 |  | 11,00000000000000 |
|  |  | 11,99999999997510 | 0,00000000002490 |  | 12,00000000000000 |
| 1951 | 0,7 | 0,99999999998098 | 0,00000000001902 | 31,4509 | 1,00000000000000 |
|  |  | 1,99999999997695 | 0,00000000002305 |  | 2,00000000000000 |
|  |  | 2,99999999997552 | 0,00000000002448 |  | 3,00000000000000 |
|  |  | 3,99999999997485 | 0,00000000002515 |  | 4,00000000000000 |
|  |  | 4,99999999997606 | 0,00000000002394 |  | 5,00000000000000 |
|  |  | 5,99999999997804 | 0,00000000002196 |  | 6,00000000000000 |
|  |  | 6,99999999997948 | 0,00000000002052 |  | 7,00000000000000 |
|  |  | 7,99999999997913 | 0,00000000002087 |  | 8,00000000000000 |
|  |  | 8,99999999997776 | 0,00000000002224 |  | 9,00000000000000 |
|  |  | 9,99999999997512 | 0,00000000002488 |  | 10,00000000000000 |
|  |  | 10,99999999997520 | 0,00000000002480 |  | 11,00000000000000 |
|  |  | 11,99999999997490 | 0,00000000002510 |  | 12,00000000000000 |
| 1706 | 0,8 | 0,99999999998113 | 0,00000000001887 | 31,363 | 1,00000000000000 |
|  |  | 1,99999999997713 | 0,00000000002287 |  | 2,00000000000000 |
|  |  | 2,99999999997571 | 0,00000000002429 |  | 3,00000000000000 |
|  |  | 3,99999999997506 | 0,00000000002494 |  | 4,00000000000000 |
|  |  | 4,99999999997625 | 0,00000000002375 |  | 5,00000000000000 |
|  |  | 5,99999999997821 | 0,00000000002179 |  | 6,00000000000000 |
|  |  | 6,99999999997964 | 0,00000000002036 |  | 7,00000000000000 |
|  |  | 7,99999999997930 | 0,00000000002070 |  | 8,00000000000000 |
|  |  | 8,99999999997794 | 0,00000000002206 |  | 9,00000000000000 |
|  |  | 9,99999999997532 | 0,00000000002468 |  | 10,00000000000000 |
|  |  | 10,99999999997540 | 0,00000000002460 |  | 11,00000000000000 |
|  |  | 11,99999999997510 | 0,00000000002490 |  | 12,00000000000000 |
| 1515 | 0,9 | 0,99999999998114 | 0,00000000001887 | 31,3441 | 1,00000000000000 |
|  |  | 1,99999999997714 | 0,00000000002286 |  | 2,00000000000000 |
|  |  | 2,99999999997572 | 0,00000000002428 |  | 3,00000000000000 |
|  |  | 3,99999999997507 | 0,00000000002493 |  | 4,00000000000000 |
|  |  | 4,99999999997626 | 0,00000000002374 |  | 5,00000000000000 |
|  |  | 5,99999999997822 | 0,00000000002178 |  | 6,00000000000000 |
|  |  | 6,99999999997965 | 0,00000000002035 |  | 7,00000000000000 |
|  |  | 7,99999999997930 | 0,00000000002070 |  | 8,00000000000000 |
|  |  | 8,99999999997795 | 0,00000000002205 |  | 9,00000000000000 |
|  |  | 9,99999999997533 | 0,00000000002467 |  | 10,00000000000000 |
|  |  | 10,99999999997540 | 0,00000000002460 |  | 11,00000000000000 |
|  |  | 11,99999999997510 | 0,00000000002490 |  | 12,00000000000000 |
| 1498 | 0,91 | 0,99999999998107 | 0,00000000001893 | 31,2661 | 1,00000000000000 |
|  |  | 1,99999999997706 | 0,00000000002294 |  | 2,00000000000000 |
|  |  | 2,99999999997563 | 0,00000000002437 |  | 3,00000000000000 |
|  |  | 3,99999999997498 | 0,00000000002502 |  | 4,00000000000000 |
|  |  | 4,99999999997618 | 0,00000000002382 |  | 5,00000000000000 |
|  |  | 5,99999999997815 | 0,00000000002185 |  | 6,00000000000000 |
|  |  | 6,99999999997958 | 0,00000000002042 |  | 7,00000000000000 |
|  |  | 7,99999999997923 | 0,00000000002077 |  | 8,00000000000000 |
|  |  | 8,99999999997787 | 0,00000000002213 |  | 9,00000000000000 |
|  |  | 9,99999999997524 | 0,00000000002476 |  | 10,00000000000000 |
|  |  | 10,99999999997530 | 0,00000000002470 |  | 11,00000000000000 |
|  |  | 11,99999999997500 | 0,00000000002500 |  | 12,00000000000000 |
| 1482 | 0,92 | 0,99999999998121 | 0,00000000001879 | 31,2901 | 1,00000000000000 |
|  |  | 1,99999999997723 | 0,00000000002277 |  | 2,00000000000000 |
|  |  | 2,99999999997582 | 0,00000000002418 |  | 3,00000000000000 |
|  |  | 3,99999999997516 | 0,00000000002484 |  | 4,00000000000000 |
|  |  | 4,99999999997635 | 0,00000000002365 |  | 5,00000000000000 |
|  |  | 5,99999999997831 | 0,00000000002169 |  | 6,00000000000000 |
|  |  | 6,99999999997973 | 0,00000000002027 |  | 7,00000000000000 |
|  |  | 7,99999999997939 | 0,00000000002061 |  | 8,00000000000000 |
|  |  | 8,99999999997804 | 0,00000000002196 |  | 9,00000000000000 |
|  |  | 9,99999999997543 | 0,00000000002457 |  | 10,00000000000000 |
|  |  | 10,99999999997550 | 0,00000000002450 |  | 11,00000000000000 |
|  |  | 11,99999999997520 | 0,00000000002480 |  | 12,00000000000000 |
| 1466 | 0,93 | 0,99999999998123 | 0,00000000001877 | 31,3004 | 1,00000000000000 |
|  |  | 1,99999999997727 | 0,00000000002273 |  | 2,00000000000000 |
|  |  | 2,99999999997585 | 0,00000000002415 |  | 3,00000000000000 |
|  |  | 3,99999999997520 | 0,00000000002480 |  | 4,00000000000000 |
|  |  | 4,99999999997639 | 0,00000000002361 |  | 5,00000000000000 |
|  |  | 5,99999999997834 | 0,00000000002166 |  | 6,00000000000000 |
|  |  | 6,99999999997976 | 0,00000000002024 |  | 7,00000000000000 |
|  |  | 7,99999999997941 | 0,00000000002059 |  | 8,00000000000000 |
|  |  | 8,99999999997807 | 0,00000000002193 |  | 9,00000000000000 |
|  |  | 9,99999999997546 | 0,00000000002454 |  | 10,00000000000000 |
|  |  | 10,99999999997560 | 0,00000000002440 |  | 11,00000000000000 |
|  |  | 11,99999999997520 | 0,00000000002480 |  | 12,00000000000000 |
| 1450 | 0,94 | 0,99999999998115 | 0,00000000001885 | 31,2518 | 1,00000000000000 |
|  |  | 1,99999999997716 | 0,00000000002284 |  | 2,00000000000000 |
|  |  | 2,99999999997573 | 0,00000000002427 |  | 3,00000000000000 |
|  |  | 3,99999999997508 | 0,00000000002492 |  | 4,00000000000000 |
|  |  | 4,99999999997627 | 0,00000000002373 |  | 5,00000000000000 |
|  |  | 5,99999999997824 | 0,00000000002176 |  | 6,00000000000000 |
|  |  | 6,99999999997966 | 0,00000000002034 |  | 7,00000000000000 |
|  |  | 7,99999999997932 | 0,00000000002068 |  | 8,00000000000000 |
|  |  | 8,99999999997796 | 0,00000000002204 |  | 9,00000000000000 |
|  |  | 9,99999999997534 | 0,00000000002466 |  | 10,00000000000000 |
|  |  | 10,99999999997540 | 0,00000000002460 |  | 11,00000000000000 |
|  |  | 11,99999999997510 | 0,00000000002490 |  | 12,00000000000000 |
| 1435 | 0,95 | 0,99999999998128 | 0,00000000001872 | 31,2884 | 1,00000000000000 |
|  |  | 1,99999999997732 | 0,00000000002268 |  | 2,00000000000000 |
|  |  | 2,99999999997591 | 0,00000000002409 |  | 3,00000000000000 |
|  |  | 3,99999999997526 | 0,00000000002474 |  | 4,00000000000000 |
|  |  | 4,99999999997645 | 0,00000000002355 |  | 5,00000000000000 |
|  |  | 5,99999999997840 | 0,00000000002160 |  | 6,00000000000000 |
|  |  | 6,99999999997981 | 0,00000000002019 |  | 7,00000000000000 |
|  |  | 7,99999999997947 | 0,00000000002053 |  | 8,00000000000000 |
|  |  | 8,99999999997813 | 0,00000000002187 |  | 9,00000000000000 |
|  |  | 9,99999999997552 | 0,00000000002448 |  | 10,00000000000000 |
|  |  | 10,99999999997560 | 0,00000000002440 |  | 11,00000000000000 |
|  |  | 11,99999999997530 | 0,00000000002470 |  | 12,00000000000000 |
| 1420 | 0,96 | 0,99999999998131 | 0,00000000001869 | 31,2784 | 1,00000000000000 |
|  |  | 1,99999999997736 | 0,00000000002264 |  | 2,00000000000000 |
|  |  | 2,99999999997595 | 0,00000000002405 |  | 3,00000000000000 |
|  |  | 3,99999999997530 | 0,00000000002470 |  | 4,00000000000000 |
|  |  | 4,99999999997648 | 0,00000000002352 |  | 5,00000000000000 |
|  |  | 5,99999999997843 | 0,00000000002157 |  | 6,00000000000000 |
|  |  | 6,99999999997984 | 0,00000000002016 |  | 7,00000000000000 |
|  |  | 7,99999999997950 | 0,00000000002050 |  | 8,00000000000000 |
|  |  | 8,99999999997816 | 0,00000000002184 |  | 9,00000000000000 |
|  |  | 9,99999999997556 | 0,00000000002444 |  | 10,00000000000000 |
|  |  | 10,99999999997570 | 0,00000000002430 |  | 11,00000000000000 |
|  |  | 11,99999999997530 | 0,00000000002470 |  | 12,00000000000000 |
| 1405 | 0,97 | 0,99999999998124 | 0,00000000001876 | 31,2676 | 1,00000000000000 |
|  |  | 1,99999999997727 | 0,00000000002273 |  | 2,00000000000000 |
|  |  | 2,99999999997585 | 0,00000000002415 |  | 3,00000000000000 |
|  |  | 3,99999999997520 | 0,00000000002480 |  | 4,00000000000000 |
|  |  | 4,99999999997639 | 0,00000000002361 |  | 5,00000000000000 |
|  |  | 5,99999999997834 | 0,00000000002166 |  | 6,00000000000000 |
|  |  | 6,99999999997976 | 0,00000000002024 |  | 7,00000000000000 |
|  |  | 7,99999999997941 | 0,00000000002059 |  | 8,00000000000000 |
|  |  | 8,99999999997807 | 0,00000000002193 |  | 9,00000000000000 |
|  |  | 9,99999999997546 | 0,00000000002454 |  | 10,00000000000000 |
|  |  | 10,99999999997560 | 0,00000000002440 |  | 11,00000000000000 |
|  |  | 11,99999999997520 | 0,00000000002480 |  | 12,00000000000000 |
| 1390 | 0,98 | 0,99999999998105 | 0,00000000001895 | 31,252 | 1,00000000000000 |
|  |  | 1,99999999997704 | 0,00000000002296 |  | 2,00000000000000 |
|  |  | 2,99999999997561 | 0,00000000002439 |  | 3,00000000000000 |
|  |  | 3,99999999997495 | 0,00000000002505 |  | 4,00000000000000 |
|  |  | 4,99999999997615 | 0,00000000002385 |  | 5,00000000000000 |
|  |  | 5,99999999997812 | 0,00000000002188 |  | 6,00000000000000 |
|  |  | 6,99999999997955 | 0,00000000002045 |  | 7,00000000000000 |
|  |  | 7,99999999997921 | 0,00000000002079 |  | 8,00000000000000 |
|  |  | 8,99999999997785 | 0,00000000002215 |  | 9,00000000000000 |
|  |  | 9,99999999997521 | 0,00000000002479 |  | 10,00000000000000 |
|  |  | 10,99999999997530 | 0,00000000002470 |  | 11,00000000000000 |
|  |  | 11,99999999997500 | 0,00000000002500 |  | 12,00000000000000 |
| 1376 | 0,99 | 0,99999999998111 | 0,00000000001889 | 31,2696 | 1,00000000000000 |
|  |  | 1,99999999997711 | 0,00000000002289 |  | 2,00000000000000 |
|  |  | 2,99999999997569 | 0,00000000002431 |  | 3,00000000000000 |
|  |  | 3,99999999997503 | 0,00000000002497 |  | 4,00000000000000 |
|  |  | 4,99999999997623 | 0,00000000002377 |  | 5,00000000000000 |
|  |  | 5,99999999997820 | 0,00000000002180 |  | 6,00000000000000 |
|  |  | 6,99999999997962 | 0,00000000002038 |  | 7,00000000000000 |
|  |  | 7,99999999997928 | 0,00000000002072 |  | 8,00000000000000 |
|  |  | 8,99999999997792 | 0,00000000002208 |  | 9,00000000000000 |
|  |  | 9,99999999997530 | 0,00000000002470 |  | 10,00000000000000 |
|  |  | 10,99999999997540 | 0,00000000002460 |  | 11,00000000000000 |
|  |  | 11,99999999997510 | 0,00000000002490 |  | 12,00000000000000 |
| 1362 | 1 | 0,99999999998107 | 0,00000000001893 | 31,2542 | 1,00000000000000 |
|  |  | 1,99999999997707 | 0,00000000002293 |  | 2,00000000000000 |
|  |  | 2,99999999997564 | 0,00000000002436 |  | 3,00000000000000 |
|  |  | 3,99999999997498 | 0,00000000002502 |  | 4,00000000000000 |
|  |  | 4,99999999997618 | 0,00000000002382 |  | 5,00000000000000 |
|  |  | 5,99999999997815 | 0,00000000002185 |  | 6,00000000000000 |
|  |  | 6,99999999997958 | 0,00000000002042 |  | 7,00000000000000 |
|  |  | 7,99999999997924 | 0,00000000002076 |  | 8,00000000000000 |
|  |  | 8,99999999997788 | 0,00000000002212 |  | 9,00000000000000 |
|  |  | 9,99999999997524 | 0,00000000002476 |  | 10,00000000000000 |
|  |  | 10,99999999997530 | 0,00000000002470 |  | 11,00000000000000 |
|  |  | 11,99999999997500 | 0,00000000002500 |  | 12,00000000000000 |

Гаусс-зейдель

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| k | w | x | x\*-x | cond | x\* |
| 13165 | 0,1 | 0,99999999998155 | 0,00000000001845 | 30,4114 | 1,00000000000000 |
|  |  | 1,99999999997766 | 0,00000000002234 |  | 2,00000000000000 |
|  |  | 2,99999999997627 | 0,00000000002373 |  | 3,00000000000000 |
|  |  | 3,99999999997562 | 0,00000000002438 |  | 4,00000000000000 |
|  |  | 4,99999999997678 | 0,00000000002322 |  | 5,00000000000000 |
|  |  | 5,99999999997870 | 0,00000000002130 |  | 6,00000000000000 |
|  |  | 6,99999999998011 | 0,00000000001989 |  | 7,00000000000000 |
|  |  | 7,99999999997978 | 0,00000000002022 |  | 8,00000000000000 |
|  |  | 8,99999999997847 | 0,00000000002153 |  | 9,00000000000000 |
|  |  | 9,99999999997590 | 0,00000000002410 |  | 10,00000000000000 |
|  |  | 10,99999999997600 | 0,00000000002400 |  | 11,00000000000000 |
|  |  | 11,99999999997570 | 0,00000000002430 |  | 12,00000000000000 |
| 6293 | 0,2 | 0,99999999998241 | 0,00000000001759 | 28,9868 | 1,00000000000000 |
|  |  | 1,99999999997871 | 0,00000000002129 |  | 2,00000000000000 |
|  |  | 2,99999999997738 | 0,00000000002262 |  | 3,00000000000000 |
|  |  | 3,99999999997676 | 0,00000000002324 |  | 4,00000000000000 |
|  |  | 4,99999999997787 | 0,00000000002213 |  | 5,00000000000000 |
|  |  | 5,99999999997970 | 0,00000000002030 |  | 6,00000000000000 |
|  |  | 6,99999999998105 | 0,00000000001895 |  | 7,00000000000000 |
|  |  | 7,99999999998075 | 0,00000000001925 |  | 8,00000000000000 |
|  |  | 8,99999999997950 | 0,00000000002050 |  | 9,00000000000000 |
|  |  | 9,99999999997706 | 0,00000000002294 |  | 10,00000000000000 |
|  |  | 10,99999999997720 | 0,00000000002280 |  | 11,00000000000000 |
|  |  | 11,99999999997690 | 0,00000000002310 |  | 12,00000000000000 |
| 4002 | 0,3 | 0,99999999998330 | 0,00000000001670 | 27,4841 | 1,00000000000000 |
|  |  | 1,99999999997979 | 0,00000000002021 |  | 2,00000000000000 |
|  |  | 2,99999999997853 | 0,00000000002147 |  | 3,00000000000000 |
|  |  | 3,99999999997793 | 0,00000000002207 |  | 4,00000000000000 |
|  |  | 4,99999999997898 | 0,00000000002102 |  | 5,00000000000000 |
|  |  | 5,99999999998071 | 0,00000000001929 |  | 6,00000000000000 |
|  |  | 6,99999999998201 | 0,00000000001799 |  | 7,00000000000000 |
|  |  | 7,99999999998174 | 0,00000000001826 |  | 8,00000000000000 |
|  |  | 8,99999999998056 | 0,00000000001944 |  | 9,00000000000000 |
|  |  | 9,99999999997825 | 0,00000000002175 |  | 10,00000000000000 |
|  |  | 10,99999999997830 | 0,00000000002170 |  | 11,00000000000000 |
|  |  | 11,99999999997810 | 0,00000000002190 |  | 12,00000000000000 |
| 2856 | 0,4 | 0,99999999998419 | 0,00000000001581 | 26,0456 | 1,00000000000000 |
|  |  | 1,99999999998087 | 0,00000000001913 |  | 2,00000000000000 |
|  |  | 2,99999999997969 | 0,00000000002031 |  | 3,00000000000000 |
|  |  | 3,99999999997911 | 0,00000000002089 |  | 4,00000000000000 |
|  |  | 4,99999999998010 | 0,00000000001990 |  | 5,00000000000000 |
|  |  | 5,99999999998174 | 0,00000000001826 |  | 6,00000000000000 |
|  |  | 6,99999999998299 | 0,00000000001701 |  | 7,00000000000000 |
|  |  | 7,99999999998274 | 0,00000000001726 |  | 8,00000000000000 |
|  |  | 8,99999999998164 | 0,00000000001836 |  | 9,00000000000000 |
|  |  | 9,99999999997944 | 0,00000000002056 |  | 10,00000000000000 |
|  |  | 10,99999999997950 | 0,00000000002050 |  | 11,00000000000000 |
|  |  | 11,99999999997930 | 0,00000000002070 |  | 12,00000000000000 |
| 2168 | 0,5 | 0,99999999998510 | 0,00000000001490 | 24,6095 | 1,00000000000000 |
|  |  | 1,99999999998198 | 0,00000000001802 |  | 2,00000000000000 |
|  |  | 2,99999999998087 | 0,00000000001913 |  | 3,00000000000000 |
|  |  | 3,99999999998032 | 0,00000000001968 |  | 4,00000000000000 |
|  |  | 4,99999999998125 | 0,00000000001875 |  | 5,00000000000000 |
|  |  | 5,99999999998279 | 0,00000000001721 |  | 6,00000000000000 |
|  |  | 6,99999999998398 | 0,00000000001602 |  | 7,00000000000000 |
|  |  | 7,99999999998376 | 0,00000000001624 |  | 8,00000000000000 |
|  |  | 8,99999999998273 | 0,00000000001727 |  | 9,00000000000000 |
|  |  | 9,99999999998066 | 0,00000000001934 |  | 10,00000000000000 |
|  |  | 10,99999999998080 | 0,00000000001920 |  | 11,00000000000000 |
|  |  | 11,99999999998050 | 0,00000000001950 |  | 12,00000000000000 |
| 1709 | 0,6 | 0,99999999998604 | 0,00000000001396 | 23,1207 | 1,00000000000000 |
|  |  | 1,99999999998312 | 0,00000000001688 |  | 2,00000000000000 |
|  |  | 2,99999999998208 | 0,00000000001792 |  | 3,00000000000000 |
|  |  | 3,99999999998156 | 0,00000000001844 |  | 4,00000000000000 |
|  |  | 4,99999999998242 | 0,00000000001758 |  | 5,00000000000000 |
|  |  | 5,99999999998387 | 0,00000000001613 |  | 6,00000000000000 |
|  |  | 6,99999999998500 | 0,00000000001500 |  | 7,00000000000000 |
|  |  | 7,99999999998481 | 0,00000000001519 |  | 8,00000000000000 |
|  |  | 8,99999999998385 | 0,00000000001615 |  | 9,00000000000000 |
|  |  | 9,99999999998191 | 0,00000000001809 |  | 10,00000000000000 |
|  |  | 10,99999999998200 | 0,00000000001800 |  | 11,00000000000000 |
|  |  | 11,99999999998180 | 0,00000000001820 |  | 12,00000000000000 |
| 1380 | 0,7 | 0,99999999998679 | 0,00000000001321 | 21,6895 | 1,00000000000000 |
|  |  | 1,99999999998404 | 0,00000000001596 |  | 2,00000000000000 |
|  |  | 2,99999999998305 | 0,00000000001695 |  | 3,00000000000000 |
|  |  | 3,99999999998255 | 0,00000000001745 |  | 4,00000000000000 |
|  |  | 4,99999999998337 | 0,00000000001663 |  | 5,00000000000000 |
|  |  | 5,99999999998474 | 0,00000000001526 |  | 6,00000000000000 |
|  |  | 6,99999999998582 | 0,00000000001418 |  | 7,00000000000000 |
|  |  | 7,99999999998565 | 0,00000000001435 |  | 8,00000000000000 |
|  |  | 8,99999999998476 | 0,00000000001524 |  | 9,00000000000000 |
|  |  | 9,99999999998293 | 0,00000000001707 |  | 10,00000000000000 |
|  |  | 10,99999999998300 | 0,00000000001700 |  | 11,00000000000000 |
|  |  | 11,99999999998280 | 0,00000000001720 |  | 12,00000000000000 |
| 1134 | 0,8 | 0,99999999998789 | 0,00000000001211 | 20,1808 | 1,00000000000000 |
|  |  | 1,99999999998538 | 0,00000000001462 |  | 2,00000000000000 |
|  |  | 2,99999999998448 | 0,00000000001552 |  | 3,00000000000000 |
|  |  | 3,99999999998401 | 0,00000000001599 |  | 4,00000000000000 |
|  |  | 4,99999999998475 | 0,00000000001525 |  | 5,00000000000000 |
|  |  | 5,99999999998600 | 0,00000000001400 |  | 6,00000000000000 |
|  |  | 6,99999999998702 | 0,00000000001298 |  | 7,00000000000000 |
|  |  | 7,99999999998688 | 0,00000000001312 |  | 8,00000000000000 |
|  |  | 8,99999999998607 | 0,00000000001393 |  | 9,00000000000000 |
|  |  | 9,99999999998439 | 0,00000000001561 |  | 10,00000000000000 |
|  |  | 10,99999999998450 | 0,00000000001550 |  | 11,00000000000000 |
|  |  | 11,99999999998430 | 0,00000000001570 |  | 12,00000000000000 |
| 941 | 0,9 | 0,99999999998859 | 0,00000000001141 | 18,7343 | 1,00000000000000 |
|  |  | 1,99999999998623 | 0,00000000001377 |  | 2,00000000000000 |
|  |  | 2,99999999998538 | 0,00000000001462 |  | 3,00000000000000 |
|  |  | 3,99999999998493 | 0,00000000001507 |  | 4,00000000000000 |
|  |  | 4,99999999998563 | 0,00000000001437 |  | 5,00000000000000 |
|  |  | 5,99999999998681 | 0,00000000001319 |  | 6,00000000000000 |
|  |  | 6,99999999998778 | 0,00000000001222 |  | 7,00000000000000 |
|  |  | 7,99999999998766 | 0,00000000001234 |  | 8,00000000000000 |
|  |  | 8,99999999998691 | 0,00000000001309 |  | 9,00000000000000 |
|  |  | 9,99999999998534 | 0,00000000001466 |  | 10,00000000000000 |
|  |  | 10,99999999998540 | 0,00000000001460 |  | 11,00000000000000 |
|  |  | 11,99999999998530 | 0,00000000001470 |  | 12,00000000000000 |
| 787 | 1 | 0,99999999998959 | 0,00000000001041 | 17,2706 | 1,00000000000000 |
|  |  | 1,99999999998746 | 0,00000000001254 |  | 2,00000000000000 |
|  |  | 2,99999999998668 | 0,00000000001332 |  | 3,00000000000000 |
|  |  | 3,99999999998626 | 0,00000000001374 |  | 4,00000000000000 |
|  |  | 4,99999999998689 | 0,00000000001311 |  | 5,00000000000000 |
|  |  | 5,99999999998797 | 0,00000000001203 |  | 6,00000000000000 |
|  |  | 6,99999999998887 | 0,00000000001113 |  | 7,00000000000000 |
|  |  | 7,99999999998879 | 0,00000000001121 |  | 8,00000000000000 |
|  |  | 8,99999999998811 | 0,00000000001189 |  | 9,00000000000000 |
|  |  | 9,99999999998668 | 0,00000000001332 |  | 10,00000000000000 |
|  |  | 10,99999999998680 | 0,00000000001320 |  | 11,00000000000000 |
|  |  | 11,99999999998660 | 0,00000000001340 |  | 12,00000000000000 |
| 660 | 1,1 | 0,99999999999041 | 0,00000000000959 | 15,7826 | 1,00000000000000 |
|  |  | 1,99999999998844 | 0,00000000001156 |  | 2,00000000000000 |
|  |  | 2,99999999998773 | 0,00000000001227 |  | 3,00000000000000 |
|  |  | 3,99999999998733 | 0,00000000001267 |  | 4,00000000000000 |
|  |  | 4,99999999998791 | 0,00000000001209 |  | 5,00000000000000 |
|  |  | 5,99999999998890 | 0,00000000001110 |  | 6,00000000000000 |
|  |  | 6,99999999998976 | 0,00000000001024 |  | 7,00000000000000 |
|  |  | 7,99999999998970 | 0,00000000001030 |  | 8,00000000000000 |
|  |  | 8,99999999998909 | 0,00000000001091 |  | 9,00000000000000 |
|  |  | 9,99999999998776 | 0,00000000001224 |  | 10,00000000000000 |
|  |  | 10,99999999998780 | 0,00000000001220 |  | 11,00000000000000 |
|  |  | 11,99999999998770 | 0,00000000001230 |  | 12,00000000000000 |
| 554 | 1,2 | 0,99999999999138 | 0,00000000000862 | 14,3108 | 1,00000000000000 |
|  |  | 1,99999999998963 | 0,00000000001037 |  | 2,00000000000000 |
|  |  | 2,99999999998899 | 0,00000000001101 |  | 3,00000000000000 |
|  |  | 3,99999999998862 | 0,00000000001138 |  | 4,00000000000000 |
|  |  | 4,99999999998913 | 0,00000000001087 |  | 5,00000000000000 |
|  |  | 5,99999999999002 | 0,00000000000998 |  | 6,00000000000000 |
|  |  | 6,99999999999082 | 0,00000000000918 |  | 7,00000000000000 |
|  |  | 7,99999999999078 | 0,00000000000922 |  | 8,00000000000000 |
|  |  | 8,99999999999024 | 0,00000000000976 |  | 9,00000000000000 |
|  |  | 9,99999999998906 | 0,00000000001094 |  | 10,00000000000000 |
|  |  | 10,99999999998910 | 0,00000000001090 |  | 11,00000000000000 |
|  |  | 11,99999999998910 | 0,00000000001090 |  | 12,00000000000000 |
| 464 | 1,3 | 0,99999999999251 | 0,00000000000750 | 12,7883 | 1,00000000000000 |
|  |  | 1,99999999999100 | 0,00000000000900 |  | 2,00000000000000 |
|  |  | 2,99999999999045 | 0,00000000000955 |  | 3,00000000000000 |
|  |  | 3,99999999999011 | 0,00000000000989 |  | 4,00000000000000 |
|  |  | 4,99999999999055 | 0,00000000000945 |  | 5,00000000000000 |
|  |  | 5,99999999999132 | 0,00000000000868 |  | 6,00000000000000 |
|  |  | 6,99999999999203 | 0,00000000000797 |  | 7,00000000000000 |
|  |  | 7,99999999999203 | 0,00000000000797 |  | 8,00000000000000 |
|  |  | 8,99999999999157 | 0,00000000000843 |  | 9,00000000000000 |
|  |  | 9,99999999999055 | 0,00000000000945 |  | 10,00000000000000 |
|  |  | 10,99999999999060 | 0,00000000000940 |  | 11,00000000000000 |
|  |  | 11,99999999999060 | 0,00000000000940 |  | 12,00000000000000 |
| 385 | 1,4 | 0,99999999999309 | 0,00000000000691 | 11,2735 | 1,00000000000000 |
|  |  | 1,99999999999172 | 0,00000000000828 |  | 2,00000000000000 |
|  |  | 2,99999999999121 | 0,00000000000879 |  | 3,00000000000000 |
|  |  | 3,99999999999088 | 0,00000000000912 |  | 4,00000000000000 |
|  |  | 4,99999999999128 | 0,00000000000872 |  | 5,00000000000000 |
|  |  | 5,99999999999199 | 0,00000000000801 |  | 6,00000000000000 |
|  |  | 6,99999999999268 | 0,00000000000732 |  | 7,00000000000000 |
|  |  | 7,99999999999270 | 0,00000000000730 |  | 8,00000000000000 |
|  |  | 8,99999999999230 | 0,00000000000770 |  | 9,00000000000000 |
|  |  | 9,99999999999135 | 0,00000000000865 |  | 10,00000000000000 |
|  |  | 10,99999999999140 | 0,00000000000860 |  | 11,00000000000000 |
|  |  | 11,99999999999140 | 0,00000000000860 |  | 12,00000000000000 |
| 378 | 1,41 | 0,99999999999332 | 0,00000000000668 | 10,466805 | 1,00000000000000 |
|  |  | 1,99999999999199 | 0,00000000000801 |  | 2,00000000000000 |
|  |  | 2,99999999999150 | 0,00000000000850 |  | 3,00000000000000 |
|  |  | 3,99999999999118 | 0,00000000000882 |  | 4,00000000000000 |
|  |  | 4,99999999999157 | 0,00000000000843 |  | 5,00000000000000 |
|  |  | 5,99999999999226 | 0,00000000000774 |  | 6,00000000000000 |
|  |  | 6,99999999999293 | 0,00000000000707 |  | 7,00000000000000 |
|  |  | 7,99999999999294 | 0,00000000000706 |  | 8,00000000000000 |
|  |  | 8,99999999999256 | 0,00000000000744 |  | 9,00000000000000 |
|  |  | 9,99999999999164 | 0,00000000000836 |  | 10,00000000000000 |
|  |  | 10,99999999999170 | 0,00000000000830 |  | 11,00000000000000 |
|  |  | 11,99999999999170 | 0,00000000000830 |  | 12,00000000000000 |
| 371 | 1,42 | 0,99999999999350 | 0,00000000000650 | 11.7361 | 1,00000000000000 |
|  |  | 1,99999999999221 | 0,00000000000779 |  | 2,00000000000000 |
|  |  | 2,99999999999173 | 0,00000000000827 |  | 3,00000000000000 |
|  |  | 3,99999999999142 | 0,00000000000858 |  | 4,00000000000000 |
|  |  | 4,99999999999179 | 0,00000000000821 |  | 5,00000000000000 |
|  |  | 5,99999999999246 | 0,00000000000754 |  | 6,00000000000000 |
|  |  | 6,99999999999312 | 0,00000000000688 |  | 7,00000000000000 |
|  |  | 7,99999999999314 | 0,00000000000686 |  | 8,00000000000000 |
|  |  | 8,99999999999276 | 0,00000000000724 |  | 9,00000000000000 |
|  |  | 9,99999999999188 | 0,00000000000812 |  | 10,00000000000000 |
|  |  | 10,99999999999190 | 0,00000000000810 |  | 11,00000000000000 |
|  |  | 11,99999999999190 | 0,00000000000810 |  | 12,00000000000000 |
| 364 | 1,43 | 0,99999999999363 | 0,00000000000637 | 10.8262 | 1,00000000000000 |
|  |  | 1,99999999999237 | 0,00000000000763 |  | 2,00000000000000 |
|  |  | 2,99999999999191 | 0,00000000000809 |  | 3,00000000000000 |
|  |  | 3,99999999999160 | 0,00000000000840 |  | 4,00000000000000 |
|  |  | 4,99999999999196 | 0,00000000000804 |  | 5,00000000000000 |
|  |  | 5,99999999999262 | 0,00000000000738 |  | 6,00000000000000 |
|  |  | 6,99999999999327 | 0,00000000000673 |  | 7,00000000000000 |
|  |  | 7,99999999999329 | 0,00000000000671 |  | 8,00000000000000 |
|  |  | 8,99999999999292 | 0,00000000000708 |  | 9,00000000000000 |
|  |  | 9,99999999999205 | 0,00000000000795 |  | 10,00000000000000 |
|  |  | 10,99999999999210 | 0,00000000000790 |  | 11,00000000000000 |
|  |  | 11,99999999999210 | 0,00000000000790 |  | 12,00000000000000 |
| 357 | 1,44 | 0,99999999999372 | 0,00000000000628 | 10.6951 | 1,00000000000000 |
|  |  | 1,99999999999248 | 0,00000000000752 |  | 2,00000000000000 |
|  |  | 2,99999999999202 | 0,00000000000798 |  | 3,00000000000000 |
|  |  | 3,99999999999172 | 0,00000000000828 |  | 4,00000000000000 |
|  |  | 4,99999999999208 | 0,00000000000792 |  | 5,00000000000000 |
|  |  | 5,99999999999273 | 0,00000000000727 |  | 6,00000000000000 |
|  |  | 6,99999999999336 | 0,00000000000664 |  | 7,00000000000000 |
|  |  | 7,99999999999339 | 0,00000000000661 |  | 8,00000000000000 |
|  |  | 8,99999999999303 | 0,00000000000697 |  | 9,00000000000000 |
|  |  | 9,99999999999218 | 0,00000000000782 |  | 10,00000000000000 |
|  |  | 10,99999999999220 | 0,00000000000780 |  | 11,00000000000000 |
|  |  | 11,99999999999220 | 0,00000000000780 |  | 12,00000000000000 |
| 350 | 1,45 | 0,99999999999378 | 0,00000000000622 | 10,4986 | 1,00000000000000 |
|  |  | 1,99999999999255 | 0,00000000000745 |  | 2,00000000000000 |
|  |  | 2,99999999999209 | 0,00000000000791 |  | 3,00000000000000 |
|  |  | 3,99999999999179 | 0,00000000000821 |  | 4,00000000000000 |
|  |  | 4,99999999999214 | 0,00000000000786 |  | 5,00000000000000 |
|  |  | 5,99999999999279 | 0,00000000000721 |  | 6,00000000000000 |
|  |  | 6,99999999999342 | 0,00000000000658 |  | 7,00000000000000 |
|  |  | 7,99999999999345 | 0,00000000000655 |  | 8,00000000000000 |
|  |  | 8,99999999999310 | 0,00000000000690 |  | 9,00000000000000 |
|  |  | 9,99999999999225 | 0,00000000000775 |  | 10,00000000000000 |
|  |  | 10,99999999999230 | 0,00000000000770 |  | 11,00000000000000 |
|  |  | 11,99999999999230 | 0,00000000000770 |  | 12,00000000000000 |
| 355 | 1,46 | 0,99999999999767 | 0,00000000000233 | 3,83136 | 1,00000000000000 |
|  |  | 1,99999999999725 | 0,00000000000275 |  | 2,00000000000000 |
|  |  | 2,99999999999711 | 0,00000000000289 |  | 3,00000000000000 |
|  |  | 3,99999999999656 | 0,00000000000344 |  | 4,00000000000000 |
|  |  | 4,99999999999743 | 0,00000000000257 |  | 5,00000000000000 |
|  |  | 5,99999999999665 | 0,00000000000335 |  | 6,00000000000000 |
|  |  | 6,99999999999768 | 0,00000000000232 |  | 7,00000000000000 |
|  |  | 7,99999999999748 | 0,00000000000252 |  | 8,00000000000000 |
|  |  | 8,99999999999757 | 0,00000000000243 |  | 9,00000000000000 |
|  |  | 9,99999999999679 | 0,00000000000321 |  | 10,00000000000000 |
|  |  | 10,99999999999760 | 0,00000000000240 |  | 11,00000000000000 |
|  |  | 11,99999999999760 | 0,00000000000240 |  | 12,00000000000000 |
| 440 | 1,47 | 1,00000000000000 | 0,00000000000000 | 0.446471 | 1,00000000000000 |
|  |  | 1,99999999999997 | 0,00000000000003 |  | 2,00000000000000 |
|  |  | 2,99999999999994 | 0,00000000000006 |  | 3,00000000000000 |
|  |  | 4,00000000000035 | -0,00000000000035 |  | 4,00000000000000 |
|  |  | 4,99999999999965 | 0,00000000000035 |  | 5,00000000000000 |
|  |  | 6,00000000000064 | -0,00000000000064 |  | 6,00000000000000 |
|  |  | 6,99999999999986 | 0,00000000000014 |  | 7,00000000000000 |
|  |  | 8,00000000000007 | -0,00000000000007 |  | 8,00000000000000 |
|  |  | 8,99999999999986 | 0,00000000000014 |  | 9,00000000000000 |
|  |  | 10,00000000000030 | -0,00000000000030 |  | 10,00000000000000 |
|  |  | 10,99999999999950 | 0,00000000000050 |  | 11,00000000000000 |
|  |  | 11,99999999999960 | 0,00000000000040 |  | 12,00000000000000 |
| 575 | 1,48 | 1,00000000000000 | 0,00000000000000 | 0.453677 | 1,00000000000000 |
|  |  | 2,00000000000003 | -0,00000000000003 |  | 2,00000000000000 |
|  |  | 3,00000000000006 | -0,00000000000006 |  | 3,00000000000000 |
|  |  | 3,99999999999964 | 0,00000000000036 |  | 4,00000000000000 |
|  |  | 5,00000000000035 | -0,00000000000035 |  | 5,00000000000000 |
|  |  | 5,99999999999935 | 0,00000000000065 |  | 6,00000000000000 |
|  |  | 7,00000000000014 | -0,00000000000014 |  | 7,00000000000000 |
|  |  | 7,99999999999993 | 0,00000000000007 |  | 8,00000000000000 |
|  |  | 9,00000000000014 | -0,00000000000014 |  | 9,00000000000000 |
|  |  | 9,99999999999968 | 0,00000000000032 |  | 10,00000000000000 |
|  |  | 11,00000000000050 | -0,00000000000050 |  | 11,00000000000000 |
|  |  | 12,00000000000050 | -0,00000000000050 |  | 12,00000000000000 |
| 824 | 1,49 | 1,00000000000000 | 0,00000000000000 | 0.460541 | 1,00000000000000 |
|  |  | 1,99999999999997 | 0,00000000000003 |  | 2,00000000000000 |
|  |  | 2,99999999999994 | 0,00000000000006 |  | 3,00000000000000 |
|  |  | 4,00000000000037 | -0,00000000000037 |  | 4,00000000000000 |
|  |  | 4,99999999999964 | 0,00000000000036 |  | 5,00000000000000 |
|  |  | 6,00000000000067 | -0,00000000000067 |  | 6,00000000000000 |
|  |  | 6,99999999999986 | 0,00000000000014 |  | 7,00000000000000 |
|  |  | 8,00000000000007 | -0,00000000000007 |  | 8,00000000000000 |
|  |  | 8,99999999999985 | 0,00000000000015 |  | 9,00000000000000 |
|  |  | 10,00000000000030 | -0,00000000000030 |  | 10,00000000000000 |
|  |  | 10,99999999999950 | 0,00000000000050 |  | 11,00000000000000 |
|  |  | 11,99999999999950 | 0,00000000000050 |  | 12,00000000000000 |
| 1441 | 1,5 | 1,00000000000000 | 0,00000000000000 | 0.466805 | 1,00000000000000 |
|  |  | 2,00000000000003 | -0,00000000000003 |  | 2,00000000000000 |
|  |  | 3,00000000000006 | -0,00000000000006 |  | 3,00000000000000 |
|  |  | 3,99999999999963 | 0,00000000000037 |  | 4,00000000000000 |
|  |  | 5,00000000000036 | -0,00000000000036 |  | 5,00000000000000 |
|  |  | 5,99999999999932 | 0,00000000000068 |  | 6,00000000000000 |
|  |  | 7,00000000000014 | -0,00000000000014 |  | 7,00000000000000 |
|  |  | 7,99999999999992 | 0,00000000000008 |  | 8,00000000000000 |
|  |  | 9,00000000000015 | -0,00000000000015 |  | 9,00000000000000 |
|  |  | 9,99999999999967 | 0,00000000000033 |  | 10,00000000000000 |
|  |  | 11,00000000000050 | -0,00000000000050 |  | 11,00000000000000 |
|  |  | 12,00000000000050 | -0,00000000000050 |  | 12,00000000000000 |

1. Тестирование на матрице с диагональным преобладанием

Якоби

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| k | w | x | x\*-x | cond | x\* |
| 608 | 0,1 | 1,00000000000006 | -0,00000000000006 | 5.41023 | 1,00000000000000 |
|  |  | 1,99999999999889 | 0,00000000000111 |  | 2,00000000000000 |
|  |  | 3,00000000000585 | -0,00000000000585 |  | 3,00000000000000 |
|  |  | 3,99999999999603 | 0,00000000000397 |  | 4,00000000000000 |
|  |  | 5,00000000000305 | -0,00000000000305 |  | 5,00000000000000 |
|  |  | 5,99999999999893 | 0,00000000000107 |  | 6,00000000000000 |
|  |  | 6,99999999999911 | 0,00000000000089 |  | 7,00000000000000 |
|  |  | 8,00000000000080 | -0,00000000000080 |  | 8,00000000000000 |
|  |  | 8,99999999999863 | 0,00000000000137 |  | 9,00000000000000 |
|  |  | 9,99999999999891 | 0,00000000000109 |  | 10,00000000000000 |
|  |  | 10,99999999999120 | 0,00000000000880 |  | 11,00000000000000 |
|  |  | 12,00000000000580 | -0,00000000000580 |  | 12,00000000000000 |
| 298 | 0,2 | 1,00000000000003 | -0,00000000000003 | 5.16275 | 1,00000000000000 |
|  |  | 1,99999999999900 | 0,00000000000100 |  | 2,00000000000000 |
|  |  | 3,00000000000532 | -0,00000000000532 |  | 3,00000000000000 |
|  |  | 3,99999999999639 | 0,00000000000361 |  | 4,00000000000000 |
|  |  | 5,00000000000277 | -0,00000000000277 |  | 5,00000000000000 |
|  |  | 5,99999999999904 | 0,00000000000096 |  | 6,00000000000000 |
|  |  | 6,99999999999918 | 0,00000000000082 |  | 7,00000000000000 |
|  |  | 8,00000000000075 | -0,00000000000075 |  | 8,00000000000000 |
|  |  | 8,99999999999875 | 0,00000000000125 |  | 9,00000000000000 |
|  |  | 9,99999999999901 | 0,00000000000099 |  | 10,00000000000000 |
|  |  | 10,99999999999200 | 0,00000000000800 |  | 11,00000000000000 |
|  |  | 12,00000000000530 | -0,00000000000530 |  | 12,00000000000000 |
| 194 | 0,3 | 1,00000000000002 | -0,00000000000002 | 4.91222 | 1,00000000000000 |
|  |  | 1,99999999999902 | 0,00000000000098 |  | 2,00000000000000 |
|  |  | 3,00000000000524 | -0,00000000000524 |  | 3,00000000000000 |
|  |  | 3,99999999999645 | 0,00000000000355 |  | 4,00000000000000 |
|  |  | 5,00000000000271 | -0,00000000000271 |  | 5,00000000000000 |
|  |  | 5,99999999999906 | 0,00000000000094 |  | 6,00000000000000 |
|  |  | 6,99999999999918 | 0,00000000000082 |  | 7,00000000000000 |
|  |  | 8,00000000000075 | -0,00000000000075 |  | 8,00000000000000 |
|  |  | 8,99999999999877 | 0,00000000000123 |  | 9,00000000000000 |
|  |  | 9,99999999999901 | 0,00000000000099 |  | 10,00000000000000 |
|  |  | 10,99999999999210 | 0,00000000000790 |  | 11,00000000000000 |
|  |  | 12,00000000000520 | -0,00000000000520 |  | 12,00000000000000 |
| 142 | 0,4 | 1,00000000000000 | 0,00000000000000 | 4.65897 | 1,00000000000000 |
|  |  | 1,99999999999906 | 0,00000000000094 |  | 2,00000000000000 |
|  |  | 3,00000000000510 | -0,00000000000510 |  | 3,00000000000000 |
|  |  | 3,99999999999655 | 0,00000000000345 |  | 4,00000000000000 |
|  |  | 5,00000000000263 | -0,00000000000263 |  | 5,00000000000000 |
|  |  | 5,99999999999909 | 0,00000000000091 |  | 6,00000000000000 |
|  |  | 6,99999999999920 | 0,00000000000080 |  | 7,00000000000000 |
|  |  | 8,00000000000075 | -0,00000000000075 |  | 8,00000000000000 |
|  |  | 8,99999999999881 | 0,00000000000119 |  | 9,00000000000000 |
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| 111 | 0,5 | 0,99999999999998 | 0,00000000000002 | 4.40979 | 1,00000000000000 |
|  |  | 1,99999999999915 | 0,00000000000085 |  | 2,00000000000000 |
|  |  | 3,00000000000463 | -0,00000000000463 |  | 3,00000000000000 |
|  |  | 3,99999999999686 | 0,00000000000314 |  | 4,00000000000000 |
|  |  | 5,00000000000238 | -0,00000000000238 |  | 5,00000000000000 |
|  |  | 5,99999999999918 | 0,00000000000082 |  | 6,00000000000000 |
|  |  | 6,99999999999926 | 0,00000000000074 |  | 7,00000000000000 |
|  |  | 8,00000000000070 | -0,00000000000070 |  | 8,00000000000000 |
|  |  | 8,99999999999892 | 0,00000000000108 |  | 9,00000000000000 |
|  |  | 9,99999999999912 | 0,00000000000088 |  | 10,00000000000000 |
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|  |  | 12,00000000000460 | -0,00000000000460 |  | 12,00000000000000 |
| 90 | 0,6 | 0,99999999999996 | 0,00000000000004 | 4.15649 | 1,00000000000000 |
|  |  | 1,99999999999917 | 0,00000000000083 |  | 2,00000000000000 |
|  |  | 3,00000000000457 | -0,00000000000457 |  | 3,00000000000000 |
|  |  | 3,99999999999691 | 0,00000000000309 |  | 4,00000000000000 |
|  |  | 5,00000000000234 | -0,00000000000234 |  | 5,00000000000000 |
|  |  | 5,99999999999920 | 0,00000000000080 |  | 6,00000000000000 |
|  |  | 6,99999999999927 | 0,00000000000073 |  | 7,00000000000000 |
|  |  | 8,00000000000071 | -0,00000000000071 |  | 8,00000000000000 |
|  |  | 8,99999999999893 | 0,00000000000107 |  | 9,00000000000000 |
|  |  | 9,99999999999913 | 0,00000000000087 |  | 10,00000000000000 |
|  |  | 10,99999999999310 | 0,00000000000690 |  | 11,00000000000000 |
|  |  | 12,00000000000460 | -0,00000000000460 |  | 12,00000000000000 |
| 76 | 0,7 | 0,99999999999996 | 0,00000000000004 | 3.9083 | 1,00000000000000 |
|  |  | 1,99999999999945 | 0,00000000000055 |  | 2,00000000000000 |
|  |  | 3,00000000000305 | -0,00000000000305 |  | 3,00000000000000 |
|  |  | 3,99999999999794 | 0,00000000000206 |  | 4,00000000000000 |
|  |  | 5,00000000000156 | -0,00000000000156 |  | 5,00000000000000 |
|  |  | 5,99999999999947 | 0,00000000000053 |  | 6,00000000000000 |
|  |  | 6,99999999999951 | 0,00000000000049 |  | 7,00000000000000 |
|  |  | 8,00000000000049 | -0,00000000000049 |  | 8,00000000000000 |
|  |  | 8,99999999999929 | 0,00000000000071 |  | 9,00000000000000 |
|  |  | 9,99999999999941 | 0,00000000000059 |  | 10,00000000000000 |
|  |  | 10,99999999999540 | 0,00000000000460 |  | 11,00000000000000 |
|  |  | 12,00000000000310 | -0,00000000000310 |  | 12,00000000000000 |
| 64 | 0,8 | 0,99999999999994 | 0,00000000000006 | 3.68427 | 1,00000000000000 |
|  |  | 1,99999999999933 | 0,00000000000067 |  | 2,00000000000000 |
|  |  | 3,00000000000375 | -0,00000000000375 |  | 3,00000000000000 |
|  |  | 3,99999999999746 | 0,00000000000254 |  | 4,00000000000000 |
|  |  | 5,00000000000190 | -0,00000000000190 |  | 5,00000000000000 |
|  |  | 5,99999999999935 | 0,00000000000065 |  | 6,00000000000000 |
|  |  | 6,99999999999938 | 0,00000000000062 |  | 7,00000000000000 |
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|  |  | 8,99999999999912 | 0,00000000000088 |  | 9,00000000000000 |
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|  |  | 12,00000000000370 | -0,00000000000370 |  | 12,00000000000000 |
| 64 | 0,81 | 0,99999999999991 | 0,00000000000009 | 3.8971 | 1,00000000000000 |
|  |  | 1,99999999999951 | 0,00000000000049 |  | 2,00000000000000 |
|  |  | 3,00000000000235 | -0,00000000000235 |  | 3,00000000000000 |
|  |  | 3,99999999999831 | 0,00000000000169 |  | 4,00000000000000 |
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| 65 | 0,82 | 1,00000000000023 | -0,00000000000023 | 1.08164 | 1,00000000000000 |
|  |  | 2,00000000000012 | -0,00000000000012 |  | 2,00000000000000 |
|  |  | 3,00000000000130 | -0,00000000000130 |  | 3,00000000000000 |
|  |  | 3,99999999999966 | 0,00000000000034 |  | 4,00000000000000 |
|  |  | 5,00000000000080 | -0,00000000000080 |  | 5,00000000000000 |
|  |  | 6,00000000000011 | -0,00000000000011 |  | 6,00000000000000 |
|  |  | 7,00000000000010 | -0,00000000000010 |  | 7,00000000000000 |
|  |  | 8,00000000000043 | -0,00000000000043 |  | 8,00000000000000 |
|  |  | 9,00000000000006 | -0,00000000000006 |  | 9,00000000000000 |
|  |  | 10,00000000000010 | -0,00000000000010 |  | 10,00000000000000 |
|  |  | 10,99999999999880 | 0,00000000000120 |  | 11,00000000000000 |
|  |  | 12,00000000000130 | -0,00000000000130 |  | 12,00000000000000 |
| 69 | 0,83 | 1,00000000000032 | -0,00000000000032 | 0.547372 | 1,00000000000000 |
|  |  | 2,00000000000037 | -0,00000000000037 |  | 2,00000000000000 |
|  |  | 3,00000000000051 | -0,00000000000051 |  | 3,00000000000000 |
|  |  | 4,00000000000036 | -0,00000000000036 |  | 4,00000000000000 |
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|  |  | 6,00000000000035 | -0,00000000000035 |  | 6,00000000000000 |
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|  |  | 9,00000000000035 | -0,00000000000035 |  | 9,00000000000000 |
|  |  | 10,00000000000040 | -0,00000000000040 |  | 10,00000000000000 |
|  |  | 11,00000000000030 | -0,00000000000030 |  | 11,00000000000000 |
|  |  | 12,00000000000050 | -0,00000000000050 |  | 12,00000000000000 |
| 74 | 0,84 | 0,99999999999967 | 0,00000000000033 | 0.568745 | 1,00000000000000 |
|  |  | 1,99999999999959 | 0,00000000000041 |  | 2,00000000000000 |
|  |  | 2,99999999999958 | 0,00000000000042 |  | 3,00000000000000 |
|  |  | 3,99999999999956 | 0,00000000000044 |  | 4,00000000000000 |
|  |  | 4,99999999999958 | 0,00000000000042 |  | 5,00000000000000 |
|  |  | 5,99999999999961 | 0,00000000000039 |  | 6,00000000000000 |
|  |  | 6,99999999999964 | 0,00000000000036 |  | 7,00000000000000 |
|  |  | 7,99999999999964 | 0,00000000000036 |  | 8,00000000000000 |
|  |  | 8,99999999999961 | 0,00000000000039 |  | 9,00000000000000 |
|  |  | 9,99999999999956 | 0,00000000000044 |  | 10,00000000000000 |
|  |  | 10,99999999999960 | 0,00000000000040 |  | 11,00000000000000 |
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| 80 | 0,85 | 0,99999999999970 | 0,00000000000030 | 0.584473 | 1,00000000000000 |
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|  |  | 4,99999999999962 | 0,00000000000038 |  | 5,00000000000000 |
|  |  | 5,99999999999965 | 0,00000000000035 |  | 6,00000000000000 |
|  |  | 6,99999999999968 | 0,00000000000032 |  | 7,00000000000000 |
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|  |  | 11,99999999999960 | 0,00000000000040 |  | 12,00000000000000 |
| 86 | 0,86 | 0,99999999999964 | 0,00000000000036 | 0.602069 | 1,00000000000000 |
|  |  | 1,99999999999957 | 0,00000000000043 |  | 2,00000000000000 |
|  |  | 2,99999999999954 | 0,00000000000046 |  | 3,00000000000000 |
|  |  | 3,99999999999953 | 0,00000000000047 |  | 4,00000000000000 |
|  |  | 4,99999999999955 | 0,00000000000045 |  | 5,00000000000000 |
|  |  | 5,99999999999959 | 0,00000000000041 |  | 6,00000000000000 |
|  |  | 6,99999999999961 | 0,00000000000039 |  | 7,00000000000000 |
|  |  | 7,99999999999961 | 0,00000000000039 |  | 8,00000000000000 |
|  |  | 8,99999999999958 | 0,00000000000042 |  | 9,00000000000000 |
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|  |  | 11,99999999999950 | 0,00000000000050 |  | 12,00000000000000 |
| 94 | 0,87 | 0,99999999999971 | 0,00000000000029 | 0.61888 | 1,00000000000000 |
|  |  | 1,99999999999965 | 0,00000000000035 |  | 2,00000000000000 |
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|  |  | 4,99999999999963 | 0,00000000000037 |  | 5,00000000000000 |
|  |  | 5,99999999999966 | 0,00000000000034 |  | 6,00000000000000 |
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|  |  | 10,99999999999960 | 0,00000000000040 |  | 11,00000000000000 |
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| 102 | 0,88 | 0,99999999999966 | 0,00000000000034 | 0.635469 | 1,00000000000000 |
|  |  | 1,99999999999958 | 0,00000000000042 |  | 2,00000000000000 |
|  |  | 2,99999999999956 | 0,00000000000044 |  | 3,00000000000000 |
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|  |  | 10,99999999999960 | 0,00000000000040 |  | 11,00000000000000 |
|  |  | 11,99999999999950 | 0,00000000000050 |  | 12,00000000000000 |
| 112 | 0,89 | 0,99999999999966 | 0,00000000000034 | 0.652651 | 1,00000000000000 |
|  |  | 1,99999999999959 | 0,00000000000041 |  | 2,00000000000000 |
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|  |  | 5,99999999999961 | 0,00000000000039 |  | 6,00000000000000 |
|  |  | 6,99999999999964 | 0,00000000000036 |  | 7,00000000000000 |
|  |  | 7,99999999999963 | 0,00000000000037 |  | 8,00000000000000 |
|  |  | 8,99999999999961 | 0,00000000000039 |  | 9,00000000000000 |
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|  |  | 10,99999999999960 | 0,00000000000040 |  | 11,00000000000000 |
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| 123 | 0,9 | 1,00000000000040 | -0,00000000000040 | 0.669168 | 1,00000000000000 |
|  |  | 2,00000000000049 | -0,00000000000049 |  | 2,00000000000000 |
|  |  | 3,00000000000052 | -0,00000000000052 |  | 3,00000000000000 |
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|  |  | 6,00000000000046 | -0,00000000000046 |  | 6,00000000000000 |
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|  |  | 1,99999999999939 | 0,00000000000061 |  | 2,00000000000000 |
|  |  | 2,99999999999935 | 0,00000000000065 |  | 3,00000000000000 |
|  |  | 3,99999999999934 | 0,00000000000066 |  | 4,00000000000000 |
|  |  | 4,99999999999937 | 0,00000000000063 |  | 5,00000000000000 |
|  |  | 5,99999999999942 | 0,00000000000058 |  | 6,00000000000000 |
|  |  | 6,99999999999946 | 0,00000000000054 |  | 7,00000000000000 |
|  |  | 7,99999999999945 | 0,00000000000055 |  | 8,00000000000000 |
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|  |  | 10,99999999999930 | 0,00000000000070 |  | 11,00000000000000 |
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Гаусс-зейдель

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| k | w | x | x\*-x | cond | x\* |
| 592 | 0,1 | 1,00000000000007 | -0,00000000000007 | 5.20488 | 1,00000000000000 |
|  |  | 1,99999999999879 | 0,00000000000121 |  | 2,00000000000000 |
|  |  | 3,00000000000591 | -0,00000000000591 |  | 3,00000000000000 |
|  |  | 3,99999999999602 | 0,00000000000398 |  | 4,00000000000000 |
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|  |  | 9,99999999999898 | 0,00000000000102 |  | 10,00000000000000 |
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|  |  | 1,99999999999885 | 0,00000000000115 |  | 2,00000000000000 |
|  |  | 3,00000000000528 | -0,00000000000528 |  | 3,00000000000000 |
|  |  | 3,99999999999649 | 0,00000000000351 |  | 4,00000000000000 |
|  |  | 5,00000000000252 | -0,00000000000252 |  | 5,00000000000000 |
|  |  | 5,99999999999929 | 0,00000000000071 |  | 6,00000000000000 |
|  |  | 6,99999999999911 | 0,00000000000089 |  | 7,00000000000000 |
|  |  | 8,00000000000076 | -0,00000000000076 |  | 8,00000000000000 |
|  |  | 8,99999999999883 | 0,00000000000117 |  | 9,00000000000000 |
|  |  | 9,99999999999916 | 0,00000000000084 |  | 10,00000000000000 |
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| 178 | 0,3 | 1,00000000000006 | -0,00000000000006 | 4.28351 | 1,00000000000000 |
|  |  | 1,99999999999884 | 0,00000000000116 |  | 2,00000000000000 |
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|  |  | 5,99999999999948 | 0,00000000000052 |  | 6,00000000000000 |
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|  |  | 8,00000000000072 | -0,00000000000072 |  | 8,00000000000000 |
|  |  | 8,99999999999894 | 0,00000000000106 |  | 9,00000000000000 |
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|  |  | 10,99999999999340 | 0,00000000000660 |  | 11,00000000000000 |
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| 126 | 0,4 | 1,00000000000008 | -0,00000000000008 | 3.81176 | 1,00000000000000 |
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|  |  | 6,99999999999920 | 0,00000000000080 |  | 7,00000000000000 |
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|  |  | 8,99999999999912 | 0,00000000000088 |  | 9,00000000000000 |
|  |  | 9,99999999999946 | 0,00000000000054 |  | 10,00000000000000 |
|  |  | 10,99999999999460 | 0,00000000000540 |  | 11,00000000000000 |
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| 94 | 0,5 | 1,00000000000012 | -0,00000000000012 | 3.33694 | 1,00000000000000 |
|  |  | 1,99999999999884 | 0,00000000000116 |  | 2,00000000000000 |
|  |  | 3,00000000000407 | -0,00000000000407 |  | 3,00000000000000 |
|  |  | 3,99999999999747 | 0,00000000000253 |  | 4,00000000000000 |
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|  |  | 5,99999999999987 | 0,00000000000013 |  | 6,00000000000000 |
|  |  | 6,99999999999918 | 0,00000000000082 |  | 7,00000000000000 |
|  |  | 8,00000000000059 | -0,00000000000059 |  | 8,00000000000000 |
|  |  | 8,99999999999918 | 0,00000000000082 |  | 9,00000000000000 |
|  |  | 9,99999999999955 | 0,00000000000045 |  | 10,00000000000000 |
|  |  | 10,99999999999500 | 0,00000000000500 |  | 11,00000000000000 |
|  |  | 12,00000000000310 | -0,00000000000310 |  | 12,00000000000000 |
| 73 | 0,6 | 1,00000000000015 | -0,00000000000015 | 2.84553 | 1,00000000000000 |
|  |  | 1,99999999999905 | 0,00000000000095 |  | 2,00000000000000 |
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|  |  | 3,99999999999824 | 0,00000000000176 |  | 4,00000000000000 |
|  |  | 5,00000000000086 | -0,00000000000086 |  | 5,00000000000000 |
|  |  | 6,00000000000004 | -0,00000000000004 |  | 6,00000000000000 |
|  |  | 6,99999999999937 | 0,00000000000063 |  | 7,00000000000000 |
|  |  | 8,00000000000040 | -0,00000000000040 |  | 8,00000000000000 |
|  |  | 8,99999999999942 | 0,00000000000058 |  | 9,00000000000000 |
|  |  | 9,99999999999972 | 0,00000000000028 |  | 10,00000000000000 |
|  |  | 10,99999999999660 | 0,00000000000340 |  | 11,00000000000000 |
|  |  | 12,00000000000210 | -0,00000000000210 |  | 12,00000000000000 |
| 57 | 0,7 | 1,00000000000025 | -0,00000000000025 | 2.33107 | 1,00000000000000 |
|  |  | 1,99999999999904 | 0,00000000000096 |  | 2,00000000000000 |
|  |  | 3,00000000000258 | -0,00000000000258 |  | 3,00000000000000 |
|  |  | 3,99999999999858 | 0,00000000000142 |  | 4,00000000000000 |
|  |  | 5,00000000000053 | -0,00000000000053 |  | 5,00000000000000 |
|  |  | 6,00000000000017 | -0,00000000000017 |  | 6,00000000000000 |
|  |  | 6,99999999999943 | 0,00000000000057 |  | 7,00000000000000 |
|  |  | 8,00000000000030 | -0,00000000000030 |  | 8,00000000000000 |
|  |  | 8,99999999999951 | 0,00000000000049 |  | 9,00000000000000 |
|  |  | 9,99999999999981 | 0,00000000000019 |  | 10,00000000000000 |
|  |  | 10,99999999999730 | 0,00000000000270 |  | 11,00000000000000 |
|  |  | 12,00000000000170 | -0,00000000000170 |  | 12,00000000000000 |
| 44 | 0,8 | 1,00000000000048 | -0,00000000000048 | 1.79173 | 1,00000000000000 |
|  |  | 1,99999999999895 | 0,00000000000105 |  | 2,00000000000000 |
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|  |  | 3,99999999999888 | 0,00000000000112 |  | 4,00000000000000 |
|  |  | 5,00000000000026 | -0,00000000000026 |  | 5,00000000000000 |
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|  |  | 6,99999999999952 | 0,00000000000048 |  | 7,00000000000000 |
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|  |  | 8,99999999999955 | 0,00000000000045 |  | 9,00000000000000 |
|  |  | 9,99999999999990 | 0,00000000000010 |  | 10,00000000000000 |
|  |  | 10,99999999999780 | 0,00000000000220 |  | 11,00000000000000 |
|  |  | 12,00000000000130 | -0,00000000000130 |  | 12,00000000000000 |
| 34 | 0,9 | 0,99999999999982 | 0,00000000000018 | 1.08739 | 1,00000000000000 |
|  |  | 2,00000000000049 | -0,00000000000049 |  | 2,00000000000000 |
|  |  | 2,99999999999956 | 0,00000000000044 |  | 3,00000000000000 |
|  |  | 3,99999999999934 | 0,00000000000066 |  | 4,00000000000000 |
|  |  | 5,00000000000161 | -0,00000000000161 |  | 5,00000000000000 |
|  |  | 5,99999999999908 | 0,00000000000092 |  | 6,00000000000000 |
|  |  | 7,00000000000046 | -0,00000000000046 |  | 7,00000000000000 |
|  |  | 7,99999999999991 | 0,00000000000009 |  | 8,00000000000000 |
|  |  | 9,00000000000005 | -0,00000000000005 |  | 9,00000000000000 |
|  |  | 10,00000000000010 | -0,00000000000010 |  | 10,00000000000000 |
|  |  | 10,99999999999990 | 0,00000000000010 |  | 11,00000000000000 |
|  |  | 11,99999999999960 | 0,00000000000040 |  | 12,00000000000000 |
| 29 | 1 | 1,00000000000022 | -0,00000000000022 | 0.789069 | 1,00000000000000 |
|  |  | 1,99999999999947 | 0,00000000000053 |  | 2,00000000000000 |
|  |  | 3,00000000000059 | -0,00000000000059 |  | 3,00000000000000 |
|  |  | 3,99999999999991 | 0,00000000000009 |  | 4,00000000000000 |
|  |  | 4,99999999999947 | 0,00000000000053 |  | 5,00000000000000 |
|  |  | 6,00000000000048 | -0,00000000000048 |  | 6,00000000000000 |
|  |  | 6,99999999999973 | 0,00000000000027 |  | 7,00000000000000 |
|  |  | 8,00000000000004 | -0,00000000000004 |  | 8,00000000000000 |
|  |  | 8,99999999999990 | 0,00000000000010 |  | 9,00000000000000 |
|  |  | 10,00000000000000 | 0,00000000000000 |  | 10,00000000000000 |
|  |  | 10,99999999999980 | 0,00000000000020 |  | 11,00000000000000 |
|  |  | 12,00000000000030 | -0,00000000000030 |  | 12,00000000000000 |
| 28 | 1,01 | 1,00000000000030 | -0,00000000000030 | 0.714535 | 1,00000000000000 |
|  |  | 1,99999999999915 | 0,00000000000085 |  | 2,00000000000000 |
|  |  | 3,00000000000060 | -0,00000000000060 |  | 3,00000000000000 |
|  |  | 4,00000000000012 | -0,00000000000012 |  | 4,00000000000000 |
|  |  | 4,99999999999926 | 0,00000000000074 |  | 5,00000000000000 |
|  |  | 6,00000000000081 | -0,00000000000081 |  | 6,00000000000000 |
|  |  | 6,99999999999960 | 0,00000000000040 |  | 7,00000000000000 |
|  |  | 8,00000000000005 | -0,00000000000005 |  | 8,00000000000000 |
|  |  | 8,99999999999994 | 0,00000000000006 |  | 9,00000000000000 |
|  |  | 10,00000000000020 | -0,00000000000020 |  | 10,00000000000000 |
|  |  | 10,99999999999990 | 0,00000000000010 |  | 11,00000000000000 |
|  |  | 12,00000000000020 | -0,00000000000020 |  | 12,00000000000000 |
| 28 | 1,02 | 1,00000000000009 | -0,00000000000009 | 0.649867 | 1,00000000000000 |
|  |  | 1,99999999999965 | 0,00000000000035 |  | 2,00000000000000 |
|  |  | 2,99999999999954 | 0,00000000000046 |  | 3,00000000000000 |
|  |  | 3,99999999999995 | 0,00000000000005 |  | 4,00000000000000 |
|  |  | 4,99999999999947 | 0,00000000000053 |  | 5,00000000000000 |
|  |  | 6,00000000000052 | -0,00000000000052 |  | 6,00000000000000 |
|  |  | 6,99999999999985 | 0,00000000000015 |  | 7,00000000000000 |
|  |  | 7,99999999999993 | 0,00000000000007 |  | 8,00000000000000 |
|  |  | 9,00000000000001 | -0,00000000000001 |  | 9,00000000000000 |
|  |  | 10,00000000000030 | -0,00000000000030 |  | 10,00000000000000 |
|  |  | 11,00000000000050 | -0,00000000000050 |  | 11,00000000000000 |
|  |  | 12,00000000000000 | 0,00000000000000 |  | 12,00000000000000 |
| 28 | 1,03 | 1,00000000000007 | -0,00000000000007 | 0.798479 | 1,00000000000000 |
|  |  | 1,99999999999995 | 0,00000000000005 |  | 2,00000000000000 |
|  |  | 2,99999999999930 | 0,00000000000070 |  | 3,00000000000000 |
|  |  | 3,99999999999932 | 0,00000000000068 |  | 4,00000000000000 |
|  |  | 4,99999999999940 | 0,00000000000060 |  | 5,00000000000000 |
|  |  | 6,00000000000035 | -0,00000000000035 |  | 6,00000000000000 |
|  |  | 6,99999999999994 | 0,00000000000006 |  | 7,00000000000000 |
|  |  | 7,99999999999984 | 0,00000000000016 |  | 8,00000000000000 |
|  |  | 8,99999999999986 | 0,00000000000014 |  | 9,00000000000000 |
|  |  | 10,00000000000020 | -0,00000000000020 |  | 10,00000000000000 |
|  |  | 11,00000000000060 | -0,00000000000060 |  | 11,00000000000000 |
|  |  | 12,00000000000020 | -0,00000000000020 |  | 12,00000000000000 |
| 29 | 1,04 | 1,00000000000015 | -0,00000000000015 | 0.546299 | 1,00000000000000 |
|  |  | 2,00000000000021 | -0,00000000000021 |  | 2,00000000000000 |
|  |  | 3,00000000000025 | -0,00000000000025 |  | 3,00000000000000 |
|  |  | 4,00000000000031 | -0,00000000000031 |  | 4,00000000000000 |
|  |  | 4,99999999999971 | 0,00000000000029 |  | 5,00000000000000 |
|  |  | 5,99999999999988 | 0,00000000000012 |  | 6,00000000000000 |
|  |  | 7,00000000000011 | -0,00000000000011 |  | 7,00000000000000 |
|  |  | 7,99999999999996 | 0,00000000000004 |  | 8,00000000000000 |
|  |  | 8,99999999999996 | 0,00000000000004 |  | 9,00000000000000 |
|  |  | 9,99999999999973 | 0,00000000000027 |  | 10,00000000000000 |
|  |  | 10,99999999999990 | 0,00000000000010 |  | 11,00000000000000 |
|  |  | 12,00000000000000 | 0,00000000000000 |  | 12,00000000000000 |
| 29 | 1,05 | 1,00000000000009 | -0,00000000000009 | 0.710375 | 1,00000000000000 |
|  |  | 2,00000000000017 | -0,00000000000017 |  | 2,00000000000000 |
|  |  | 3,00000000000042 | -0,00000000000042 |  | 3,00000000000000 |
|  |  | 4,00000000000077 | -0,00000000000077 |  | 4,00000000000000 |
|  |  | 4,99999999999982 | 0,00000000000018 |  | 5,00000000000000 |
|  |  | 5,99999999999972 | 0,00000000000028 |  | 6,00000000000000 |
|  |  | 7,00000000000019 | -0,00000000000019 |  | 7,00000000000000 |
|  |  | 8,00000000000005 | -0,00000000000005 |  | 8,00000000000000 |
|  |  | 9,00000000000009 | -0,00000000000009 |  | 9,00000000000000 |
|  |  | 9,99999999999975 | 0,00000000000025 |  | 10,00000000000000 |
|  |  | 10,99999999999980 | 0,00000000000020 |  | 11,00000000000000 |
|  |  | 11,99999999999980 | 0,00000000000020 |  | 12,00000000000000 |
| 29 | 1,06 | 0,99999999999982 | 0,00000000000018 | 0.601497 | 1,00000000000000 |
|  |  | 1,99999999999988 | 0,00000000000012 |  | 2,00000000000000 |
|  |  | 3,00000000000020 | -0,00000000000020 |  | 3,00000000000000 |
|  |  | 4,00000000000115 | -0,00000000000115 |  | 4,00000000000000 |
|  |  | 5,00000000000006 | -0,00000000000006 |  | 5,00000000000000 |
|  |  | 5,99999999999941 | 0,00000000000059 |  | 6,00000000000000 |
|  |  | 7,00000000000023 | -0,00000000000023 |  | 7,00000000000000 |
|  |  | 8,00000000000022 | -0,00000000000022 |  | 8,00000000000000 |
|  |  | 9,00000000000033 | -0,00000000000033 |  | 9,00000000000000 |
|  |  | 10,00000000000010 | -0,00000000000010 |  | 10,00000000000000 |
|  |  | 10,99999999999990 | 0,00000000000010 |  | 11,00000000000000 |
|  |  | 11,99999999999960 | 0,00000000000040 |  | 12,00000000000000 |
| 30 | 1,07 | 0,99999999999982 | 0,00000000000018 | 0.639958 | 1,00000000000000 |
|  |  | 1,99999999999987 | 0,00000000000013 |  | 2,00000000000000 |
|  |  | 2,99999999999948 | 0,00000000000052 |  | 3,00000000000000 |
|  |  | 3,99999999999965 | 0,00000000000035 |  | 4,00000000000000 |
|  |  | 5,00000000000069 | -0,00000000000069 |  | 5,00000000000000 |
|  |  | 6,00000000000017 | -0,00000000000017 |  | 6,00000000000000 |
|  |  | 6,99999999999977 | 0,00000000000023 |  | 7,00000000000000 |
|  |  | 7,99999999999999 | 0,00000000000001 |  | 8,00000000000000 |
|  |  | 9,00000000000000 | 0,00000000000000 |  | 9,00000000000000 |
|  |  | 10,00000000000020 | -0,00000000000020 |  | 10,00000000000000 |
|  |  | 11,00000000000010 | -0,00000000000010 |  | 11,00000000000000 |
|  |  | 11,99999999999990 | 0,00000000000010 |  | 12,00000000000000 |
| 31 | 1,08 | 1,00000000000017 | -0,00000000000017 | 0.799313 | 1,00000000000000 |
|  |  | 2,00000000000013 | -0,00000000000013 |  | 2,00000000000000 |
|  |  | 3,00000000000025 | -0,00000000000025 |  | 3,00000000000000 |
|  |  | 3,99999999999970 | 0,00000000000030 |  | 4,00000000000000 |
|  |  | 4,99999999999953 | 0,00000000000047 |  | 5,00000000000000 |
|  |  | 6,00000000000026 | -0,00000000000026 |  | 6,00000000000000 |
|  |  | 7,00000000000010 | -0,00000000000010 |  | 7,00000000000000 |
|  |  | 7,99999999999992 | 0,00000000000008 |  | 8,00000000000000 |
|  |  | 8,99999999999991 | 0,00000000000009 |  | 9,00000000000000 |
|  |  | 9,99999999999991 | 0,00000000000009 |  | 10,00000000000000 |
|  |  | 11,00000000000000 | 0,00000000000000 |  | 11,00000000000000 |
|  |  | 12,00000000000030 | -0,00000000000030 |  | 12,00000000000000 |
| 31 | 1,09 | 1,00000000000024 | -0,00000000000024 | 0.702022 | 1,00000000000000 |
|  |  | 2,00000000000006 | -0,00000000000006 |  | 2,00000000000000 |
|  |  | 3,00000000000056 | -0,00000000000056 |  | 3,00000000000000 |
|  |  | 3,99999999999975 | 0,00000000000025 |  | 4,00000000000000 |
|  |  | 4,99999999999869 | 0,00000000000131 |  | 5,00000000000000 |
|  |  | 5,99999999999999 | 0,00000000000001 |  | 6,00000000000000 |
|  |  | 7,00000000000032 | -0,00000000000032 |  | 7,00000000000000 |
|  |  | 7,99999999999998 | 0,00000000000002 |  | 8,00000000000000 |
|  |  | 8,99999999999993 | 0,00000000000007 |  | 9,00000000000000 |
|  |  | 9,99999999999990 | 0,00000000000010 |  | 10,00000000000000 |
|  |  | 11,00000000000010 | -0,00000000000010 |  | 11,00000000000000 |
|  |  | 12,00000000000050 | -0,00000000000050 |  | 12,00000000000000 |
| 32 | 1,1 | 0,99999999999983 | 0,00000000000017 | 0.712962 | 1,00000000000000 |
|  |  | 1,99999999999989 | 0,00000000000011 |  | 2,00000000000000 |
|  |  | 2,99999999999983 | 0,00000000000017 |  | 3,00000000000000 |
|  |  | 4,00000000000069 | -0,00000000000069 |  | 4,00000000000000 |
|  |  | 5,00000000000055 | -0,00000000000055 |  | 5,00000000000000 |
|  |  | 5,99999999999940 | 0,00000000000060 |  | 6,00000000000000 |
|  |  | 6,99999999999986 | 0,00000000000014 |  | 7,00000000000000 |
|  |  | 8,00000000000011 | -0,00000000000011 |  | 8,00000000000000 |
|  |  | 9,00000000000007 | -0,00000000000007 |  | 9,00000000000000 |
|  |  | 9,99999999999988 | 0,00000000000012 |  | 10,00000000000000 |
|  |  | 10,99999999999990 | 0,00000000000010 |  | 11,00000000000000 |
|  |  | 11,99999999999950 | 0,00000000000050 |  | 12,00000000000000 |
| 42 | 1,2 | 0,99999999999994 | 0,00000000000006 | 0.53325 | 1,00000000000000 |
|  |  | 2,00000000000000 | 0,00000000000000 |  | 2,00000000000000 |
|  |  | 2,99999999999989 | 0,00000000000011 |  | 3,00000000000000 |
|  |  | 4,00000000000022 | -0,00000000000022 |  | 4,00000000000000 |
|  |  | 5,00000000000022 | -0,00000000000022 |  | 5,00000000000000 |
|  |  | 5,99999999999959 | 0,00000000000041 |  | 6,00000000000000 |
|  |  | 6,99999999999982 | 0,00000000000018 |  | 7,00000000000000 |
|  |  | 8,00000000000000 | 0,00000000000000 |  | 8,00000000000000 |
|  |  | 8,99999999999992 | 0,00000000000008 |  | 9,00000000000000 |
|  |  | 9,99999999999968 | 0,00000000000032 |  | 10,00000000000000 |
|  |  | 10,99999999999980 | 0,00000000000020 |  | 11,00000000000000 |
|  |  | 11,99999999999970 | 0,00000000000030 |  | 12,00000000000000 |
| 55 | 1,3 | 0,99999999999988 | 0,00000000000013 | 0.749382 | 1,00000000000000 |
|  |  | 2,00000000000005 | -0,00000000000005 |  | 2,00000000000000 |
|  |  | 2,99999999999979 | 0,00000000000021 |  | 3,00000000000000 |
|  |  | 4,00000000000041 | -0,00000000000041 |  | 4,00000000000000 |
|  |  | 5,00000000000045 | -0,00000000000045 |  | 5,00000000000000 |
|  |  | 5,99999999999951 | 0,00000000000049 |  | 6,00000000000000 |
|  |  | 6,99999999999976 | 0,00000000000024 |  | 7,00000000000000 |
|  |  | 8,00000000000002 | -0,00000000000002 |  | 8,00000000000000 |
|  |  | 8,99999999999994 | 0,00000000000006 |  | 9,00000000000000 |
|  |  | 9,99999999999955 | 0,00000000000045 |  | 10,00000000000000 |
|  |  | 10,99999999999960 | 0,00000000000040 |  | 11,00000000000000 |
|  |  | 11,99999999999950 | 0,00000000000050 |  | 12,00000000000000 |
| 72 | 1,4 | 1,00000000000033 | -0,00000000000033 | 0.933476 | 1,00000000000000 |
|  |  | 2,00000000000008 | -0,00000000000008 |  | 2,00000000000000 |
|  |  | 3,00000000000066 | -0,00000000000066 |  | 3,00000000000000 |
|  |  | 3,99999999999943 | 0,00000000000057 |  | 4,00000000000000 |
|  |  | 4,99999999999943 | 0,00000000000057 |  | 5,00000000000000 |
|  |  | 6,00000000000125 | -0,00000000000125 |  | 6,00000000000000 |
|  |  | 7,00000000000040 | -0,00000000000040 |  | 7,00000000000000 |
|  |  | 7,99999999999981 | 0,00000000000019 |  | 8,00000000000000 |
|  |  | 9,00000000000008 | -0,00000000000008 |  | 9,00000000000000 |
|  |  | 10,00000000000080 | -0,00000000000080 |  | 10,00000000000000 |
|  |  | 11,00000000000060 | -0,00000000000060 |  | 11,00000000000000 |
|  |  | 12,00000000000090 | -0,00000000000090 |  | 12,00000000000000 |
| 98 | 1,5 | 0,99999999999995 | 0,00000000000005 | 1.43921 | 1,00000000000000 |
|  |  | 2,00000000000096 | -0,00000000000096 |  | 2,00000000000000 |
|  |  | 3,00000000000048 | -0,00000000000048 |  | 3,00000000000000 |
|  |  | 4,00000000000082 | -0,00000000000082 |  | 4,00000000000000 |
|  |  | 5,00000000000184 | -0,00000000000184 |  | 5,00000000000000 |
|  |  | 6,00000000000185 | -0,00000000000185 |  | 6,00000000000000 |
|  |  | 6,99999999999966 | 0,00000000000034 |  | 7,00000000000000 |
|  |  | 7,99999999999949 | 0,00000000000051 |  | 8,00000000000000 |
|  |  | 9,00000000000006 | -0,00000000000006 |  | 9,00000000000000 |
|  |  | 9,99999999999958 | 0,00000000000042 |  | 10,00000000000000 |
|  |  | 10,99999999999860 | 0,00000000000140 |  | 11,00000000000000 |
|  |  | 12,00000000000000 | 0,00000000000000 |  | 12,00000000000000 |
| 153 | 1,6 | 1,00000000000037 | -0,00000000000037 | 1.32778 | 1,00000000000000 |
|  |  | 1,99999999999861 | 0,00000000000139 |  | 2,00000000000000 |
|  |  | 2,99999999999966 | 0,00000000000034 |  | 3,00000000000000 |
|  |  | 4,00000000000063 | -0,00000000000063 |  | 4,00000000000000 |
|  |  | 5,00000000000153 | -0,00000000000153 |  | 5,00000000000000 |
|  |  | 6,00000000000138 | -0,00000000000138 |  | 6,00000000000000 |
|  |  | 7,00000000000047 | -0,00000000000047 |  | 7,00000000000000 |
|  |  | 8,00000000000034 | -0,00000000000034 |  | 8,00000000000000 |
|  |  | 9,00000000000005 | -0,00000000000005 |  | 9,00000000000000 |
|  |  | 9,99999999999965 | 0,00000000000035 |  | 10,00000000000000 |
|  |  | 10,99999999999830 | 0,00000000000170 |  | 11,00000000000000 |
|  |  | 11,99999999999920 | 0,00000000000080 |  | 12,00000000000000 |
| 1224 | 1,7 | 0,99999999999957 | 0,00000000000043 | 1.52572 | 1,00000000000000 |
|  |  | 2,00000000000165 | -0,00000000000165 |  | 2,00000000000000 |
|  |  | 3,00000000000029 | -0,00000000000029 |  | 3,00000000000000 |
|  |  | 3,99999999999920 | 0,00000000000080 |  | 4,00000000000000 |
|  |  | 4,99999999999834 | 0,00000000000166 |  | 5,00000000000000 |
|  |  | 5,99999999999828 | 0,00000000000172 |  | 6,00000000000000 |
|  |  | 6,99999999999947 | 0,00000000000053 |  | 7,00000000000000 |
|  |  | 7,99999999999958 | 0,00000000000042 |  | 8,00000000000000 |
|  |  | 9,00000000000002 | -0,00000000000002 |  | 9,00000000000000 |
|  |  | 10,00000000000050 | -0,00000000000050 |  | 10,00000000000000 |
|  |  | 11,00000000000220 | -0,00000000000220 |  | 11,00000000000000 |
|  |  | 12,00000000000060 | -0,00000000000060 |  | 12,00000000000000 |

1. Вывод   
   *Юрганов Егор*  
   Количество итераций рассмотренных методов в зависимости от параметра релаксации имеет один характер: плавное убивание до точки минимума и затем резкое возрастание и метод начинает расходиться. Конкретное поведение: скорость возрастания и убывания определяются матрицей. На тестируемых матрицах зависимости количества итераций от параметра релаксации для всех методов подобны. Например, для матрицы A после прохождения минимума число итераций резко возрастает и методы расходится, для матрицы B после прохождения минимума сначала идёт небольшой возрастание, а уже затем резкое возрастание. В случае матрицы с маленьким числом обусловленности (матрицы B) минимальное количество итераций и параметры релаксации не сильно отличаются друг от друга. В случае, когда матрица имеет большее число обусловленности (матрица А) количества итераций отличаются.

*Басов Денис*

Оптимальные параметры релаксации: для якоби (А) w=1, для якоби (В) w=0.8-0.81, для гаусса-зейделя (А) w=1.46, для якоби (В) w=1.01-1.03.

Для матрицы B, у которой маленькое число обусловленностей, минимальное количество итераций и нет единого параметра релаксации. Также метод расходиться при большем параметре релаксации.

1. Текст программы

Main

#include <math.h>

#include <stdlib.h>

#include <stdio.h>

#include <conio.h>

#include <iostream>

#include "subroutine.h"

using namespace std;

int main()

{

matrix A;

A.read();

A.iter();

}

subroutine.h

#pragma once

#include <math.h>

#include <stdlib.h>

#include <stdio.h>

#include <conio.h>

#include <iostream>

#include <fstream>

#include <iomanip>

using namespace std;

class matrix {

private:

int n, m, n1, n2, n3, maxk, nb=2;

double\* ld, \* l1, \* l2, \* l3, \* ud, \* u1, \* u2, \* u3, \* di, \* f, \* x, \*t, \* xx, eps, w;

public:

void read();

double mult(int i, double\* x, double\* xx);

void iter();

void factorize();

void LUsolution(double\* x, int blocknumber, double w);

void multBV(int blocknumber, double\* x);

void BL(double\* x, double& pogrBL);

void BlockRelaxation();

};

void matrix::read() {

ifstream fin;

fin.open("in.txt");

fin >> n >> m >> eps >> maxk >> w;

n1 = m + 2;

n2 = m + 3;

n3 = m + 4;

x = new double[n];

xx = new double[n];

t = new double[n];

f = new double [n];

di = new double[n];

ld = new double[n - 1];

l1 = new double[n - n1];

l2 = new double[n - n2];

l3 = new double[n - n3];

ud = new double[n - 1];

u1 = new double[n - n1];

u2 = new double[n - n2];

u3 = new double[n - n3];

/\*for (int i = 0; i < n; i++) {

x[i] = 0;

xx[i] = 0;

}\*/

for (int i = 0; i < n; i++)

fin >> x[i];

for (int i = 0; i < n; i++)

fin >> f[i];

for (int i = 0; i < n; i++)

fin >> di[i];

for (int i = 0; i < n-1; i++)

fin >> ld[i];

for (int i = 0; i < n - n1; i++)

fin >> l1[i];

for (int i = 0; i < n - n2; i++)

fin >> l2[i];

for (int i = 0; i < n - n3; i++)

fin >> l3[i];

for (int i = 0; i < n - 1; i++)

fin >> ud[i];

for (int i = 0; i < n - n1; i++)

fin >> u1[i];

for (int i = 0; i < n - n2; i++)

fin >> u2[i];

for (int i = 0; i < n - n3; i++)

fin >> u3[i];

}

double norm(double \*x, int n) {

double sum = 0;

for (int i = 0; i < n; i++)

sum += x[i] \* x[i];

return sqrt(sum);

}

double norm2(double\* x, double\* v, int n) {

double sum = 0;

for (int i = 0; i < n; i++)

sum += (v[i] - x[i]) \* (v[i] - x[i]);

return sqrt(sum);

}

double matrix::mult(int i, double\* x, double\* xx) {

double sum = 0, a = 0;

for (int j = 0; j < n; j++)

{

if (i == j) a = di[i]; // главная диагональ

else

{

int r = j - i;

if (r == 1) a = ud[i]; //верхние диагонали

else if (r == n1) a = u1[i];

else if (r == n2) a = u2[i];

else if (r == n3) a = u3[i];

else if (r == -1) a = ld[j]; //нижние диагонали

else if (r == -n1) a = l1[j];

else if (r == -n2) a = l2[j];

else if (r == -n3) a = l3[j];

else a = 0;

}

sum += a \* x[j];

}

xx[i] = x[i] + (f[i] - sum) \* w / di[i];

return sum;

}

void matrix::iter() {

double\* A = new double[n];

int k = 0,flag;

ofstream out;

out.open("out.txt");

cout << "1 2\n";

cin >> flag;

if (flag == 1) {

while (k < maxk && (norm2(f, A, n) / norm(f, n)) > eps) {

for (int i = 0; i < n; i++)

A[i] = mult(i, x, xx);

swap(xx, x);

k++;

}

double\* mas = new double[n];

for (int i = 1; i <= n; i++)

mas[i - 1] = i;

cout << "yacobi:\n";

double ob = (norm2(mas, x, n) / norm(mas, n)) / (norm2(A, f, n) / norm(f, n));

cout << ob << "\n" << k << "\n";

out << ob << "\n" << k << "\n";

for (int i = 0; i < n; i++) {

cout << setprecision(15) << x[i] << " ";

out << setprecision(15) << x[i] << "\n";

}

cout << "\n";

}

else {

while (k < maxk && norm2(f, A, n) / norm(f, n)> eps) {

for (int i = 0; i < n; i++)

A[i] = mult(i, x, x);

k++;

}

double\* mas = new double[n];

for (int i = 1; i <= n; i++)

mas[i-1] = i;

cout << "gausszeidel:\n";

double ob = (norm2(mas, x, n) / norm(mas, n)) / (norm2(A, f, n) / norm(f, n));

cout << ob << "\n" << k << "\n";

out << ob << "\n" << k << "\n";

for (int i = 0; i < n; i++) {

cout << setprecision(15) << x[i] << " ";

out << setprecision(15) << x[i] << "\n";

}

cout << "\n";

}

}