参数说明：

HC：Hit Count，命中次数。

MC：Miss Count，不命中次数。

AC：Access Count，访问Cache次数。

RC：Read Count，读取次数。

WC：Write Count，写入次数。

HR：Hit Ratio，命中率。

MR：Miss Ratio, 不命中率。

TRT：Total Read Time，总读取时间。

TWT：Total Write Time，总写入时间。

TAT：Total Access Time，总访问时间。

ART：Average Read Time, 平均读取时间。

AWT：Average Write Time，平均写入时间。

AAT：Average Access Time，平均访问时间。

TAB：Total Access Bytes，总访存字节数。

TP：throughPut，吞入量。

AML：Access Memory Latency，访问内存时间。

SUR：Speed Up Ratio，加速比。

----------Group Associated Mapping Cache----------

Using Write Back Strategy.

Using FIFO Replacement Strategy.

4 lines in a set.

Cache parameters:

Cache Size: 256B, Line Size: 16B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 4

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表1：GAMCache的性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Size | Stride | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| 64 | **8** | 86.9795 | 13.0205 | 5.26785 | 3.73003 | 4.73586 | 805.493 | 72.142 |
| 64 | **16** | 93.4872 | 6.51278 | 3.38227 | 3.72295 | 3.50019 | 1089.85 | 79.4106 |
| 64 | **32** | 93.5028 | 6.49724 | 3.37668 | 3.72631 | 3.49771 | 1090.63 | 79.4253 |
| 64 | **64** | 93.5105 | 6.48947 | 3.37478 | 3.72631 | 3.49646 | 1091.02 | 79.4326 |
| 128 | **8** | 83.1585 | 16.8415 | 6.20563 | 3.72654 | 5.34748 | 713.364 | 68.5442 |
| 128 | **16** | 85.7198 | 14.2802 | 5.27971 | 3.72643 | 4.74241 | 804.379 | 72.1035 |
| 128 | **32** | 93.4708 | 6.52918 | 3.3837 | 3.72643 | 3.50226 | 1089.21 | 79.3985 |
| 128 | **64** | 93.4864 | 6.51362 | 3.37811 | 3.72981 | 3.49977 | 1089.99 | 79.4131 |
| 256 | **8** | 83.1585 | 16.8415 | 6.20563 | 3.72654 | 5.34748 | 713.364 | 68.5442 |
| 256 | **16** | 85.7198 | 14.0802 | 5.27971 | 3.72643 | 4.74241 | 804.376 | 72.1035 |
| 256 | **32** | 85.7198 | 14.2802 | 5.2797 | 3.72643 | 4.74241 | 804.379 | 72.1035 |
| 256 | **64** | 93.4708 | 6.52918 | 3.3837 | 3.72643 | 3.50226 | 1089.21 | 79.3985 |
| 512 | **8** | 84.8216 | 15.1784 | 5.73208 | 3.68388 | 5.02308 | 759.434 | 70.4525 |
| 512 | **16** | 85.7588 | 14.2412 | 5.27472 | 3.69426 | 4.72802 | 806.828 | 72.1881 |
| 512 | **32** | 85.7588 | 14.2412 | 5.27372 | 3.69426 | 4.72802 | 806.828 | 72.1881 |
| 512 | **64** | 85.7588 | 14.2412 | 5.27472 | 3.69426 | 4.72802 | 806.828 | 72.1881 |
| 512 | **128** | 84.8264 | 15.1736 | 5.72841 | 3.69084 | 5.02331 | 759.399 | 70.4511 |
| 1024 | **8** | 84.786 | 15.214 | 5.73575 | 3.69426 | 5.02957 | 758.454 | 70.4143 |
| 1024 | **16** | 85.7975 | 14.2025 | 5.26803 | 3.69084 | 4.72224 | 807.815 | 72.2221 |
| 1024 | **32** | 85.7975 | 14.2025 | 5.26803 | 3.69084 | 4.72224 | 807.815 | 72.2221 |
| 1024 | **64** | 85.7975 | 14.2025 | 5.26803 | 3.69084 | 4.72224 | 807.815 | 72.2221 |
| 1024 | **128** | 84.8063 | 15.1937 | 5.73017 | 3.69426 | 5.02614 | 758.972 | 70.4345 |
| 2048 | **8** | 84.786 | 15.214 | 5.73575 | 3.69426 | 5.02957 | 758.454 | 70.4143 |
| 2048 | **16** | 85.7975 | 14.2025 | 5.26803 | 3.69084 | 4.72224 | 807.815 | 72.2221 |
| 2048 | **32** | 85.7975 | 14.2025 | 5.26803 | 3.69084 | 4.72224 | 807.815 | 72.2221 |
| 2048 | **64** | 85.7975 | 14.2025 | 5.26803 | 3.69084 | 4.72224 | 807.815 | 72.2221 |
| 2048 | **128** | 85.7787 | 14.2213 | 5.26935 | 3.69426 | 4.72468 | 807.398 | 72.2078 |
| 2048 | **256** | 85.7787 | 14.2213 | 5.26935 | 3.69426 | 4.72468 | 807.398 | 72.2078 |

注：Size：数组内元素个数，Stride：相邻两次访问的两个元素之间的元素个数。

--------------Directed Mapping Cache--------------

Using Write Back Strategy.

Cache parameters:

Cache Size: 256B, Line Size: 16B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 4

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表2：DMCache的性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Size | Stride | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| 64 | **8** | 88.9096 | 11.0904 | 5.88743 | 4.21372 | 5.30843 | 718.611 | 68.7739 |
| 64 | **16** | 92.8188 | 7.18116 | 4.09319 | 4.21599 | 4.1357 | 922.383 | 75.6724 |
| 64 | **32** | 92.8344 | 7.16562 | 4.08606 | 4.21599 | 4.13103 | 923.425 | 75.6998 |
| 64 | **64** | 92.8422 | 7.15785 | 4.08249 | 4.21599 | 4.1287 | 923.946 | 75.7135 |
| 128 | **8** | 83.1429 | 16.8571 | 8.53275 | 4.21599 | 7.03847 | 541.978 | 58.5972 |
| 128 | **16** | 85.0584 | 14.9416 | 7.65378 | 4.21372 | 6.46381 | 590.162 | 61.9776 |
| 128 | **32** | 85.0584 | 14.9416 | 7.65378 | 4.21372 | 6.46381 | 590.162 | 61.9776 |
| 128 | **64** | 85.0584 | 14.9416 | 7.65378 | 4.21372 | 6.46381 | 590.162 | 61.9776 |
| 256 | **8** | 83.1429 | 16.8571 | 8.53275 | 4.21599 | 7.03847 | 541.978 | 58.5972 |
| 256 | **16** | 85.0584 | 14.9416 | 7.65378 | 4.21372 | 6.46381 | 590.162 | 61.9776 |
| 256 | **32** | 85.0584 | 14.9416 | 7.65378 | 4.21372 | 6.46381 | 590.162 | 61.9776 |
| 256 | **64** | 85.0584 | 14.9416 | 7.65378 | 4.21372 | 6.46381 | 590.162 | 61.9776 |
| 512 | **8** | 84.1222 | 15.8778 | 8.06383 | 4.25303 | 6.7447 | 565.585 | 60.3253 |
| 512 | **16** | 85.0817 | 14.9183 | 7.61987 | 4.25759 | 6.45681 | 590.802 | 62.0188 |
| 512 | **32** | 85.0817 | 14.9183 | 7.61987 | 4.25759 | 6.45681 | 590.802 | 62.0188 |
| 512 | **64** | 85.0817 | 14.9183 | 7.61987 | 4.25759 | 6.45681 | 590.802 | 62.0188 |
| 512 | **128** | 84.1271 | 15.8729 | 8.06095 | 4.25303 | 6.74322 | 565.708 | 60.334 |
| 1024 | **8** | 84.1089 | 15.8911 | 8.06603 | 4.25759 | 6.74864 | 565.254 | 60.3021 |
| 1024 | **16** | 85.0983 | 14.9017 | 7.61542 | 4.25303 | 6.45187 | 591.255 | 62.0478 |
| 1024 | **32** | 85.0983 | 14.9017 | 7.61542 | 4.25303 | 6.45187 | 591.255 | 62.0478 |
| 1024 | **64** | 85.0983 | 14.9017 | 7.61542 | 4.25303 | 6.45187 | 591.255 | 62.0478 |
| 1024 | **128** | 84.1295 | 15.8705 | 8.05601 | 4.25759 | 6.74249 | 565.77 | 60.3383 |
| 2048 | **8** | 84.1089 | 15.8911 | 8.06603 | 4.25759 | 6.74864 | 565.254 | 60.3021 |
| 2048 | **16** | 85.0983 | 14.9017 | 7.61542 | 4.25303 | 6.45187 | 591.255 | 62.0478 |
| 2048 | **32** | 85.0983 | 14.9017 | 7.61542 | 4.25303 | 6.45187 | 591.255 | 62.0478 |
| 2048 | **64** | 85.0983 | 14.9017 | 7.61542 | 4.25303 | 6.45187 | 591.255 | 62.0478 |
| 2048 | **128** | 85.1019 | 14.8981 | 7.61006 | 4.25759 | 6.45075 | 591.357 | 62.0544 |
| 2048 | **256** | 85.1019 | 14.8981 | 7.61006 | 4.25759 | 6.45075 | 591.357 | 62.0544 |

----------Fully Associated Mapping Cache----------

Using Write Back Strategy.

Using FIFO Replacement Strategy.

Cache parameters:

Cache Size: 256B, Line Size: 16B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 4

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表3：FAMCache的性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Size | Stride | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| 64 | **8** | 93.6337 | 6.36625 | 3.38767 | 3.5829 | 3.45521 | 1104.04 | 79.6721 |
| 64 | **16** | 93.6893 | 6.31072 | 3.37656 | 3.57634 | 3.44571 | 1107.08 | 79.7311 |
| 64 | **32** | 93.7048 | 6.29517 | 3.36919 | 3.58307 | 3.44323 | 1107.88 | 79.7457 |
| 64 | **64** | 93.7126 | 6.2874 | 3.37085 | 3.57634 | 3.44198 | 1108.28 | 79.753 |
| 128 | **8** | 84.9149 | 15.0851 | 5.64495 | 3.57297 | 4.92772 | 774.13 | 71.0134 |
| 128 | **16** | 93.6342 | 6.36576 | 3.39108 | 3.57615 | 3.4551 | 1104.08 | 79.6759 |
| 128 | **32** | 93.6732 | 6.32685 | 3.37799 | 3.57953 | 3.4477 | 1106.45 | 79.7194 |
| 128 | **64** | 93.6887 | 6.31128 | 3.37061 | 3.58628 | 3.44521 | 1107.25 | 79.734 |
| 256 | **8** | 84.9149 | 15.0851 | 5.64495 | 3.57297 | 4.92772 | 774.13 | 71.0134 |
| 256 | **16** | 84.8872 | 15.1128 | 5.64854 | 3.57615 | 4.93167 | 773.51 | 70.9902 |
| 256 | **32** | 93.6342 | 6.36576 | 3.39108 | 3.57615 | 3.4551 | 1104.08 | 79.6759 |
| 256 | **64** | 93.6732 | 6.32685 | 3.37799 | 3.57953 | 3.4477 | 1106.45 | 79.7194 |
| 512 | **8** | 84.9227 | 15.0773 | 5.64305 | 3.57297 | 4.92648 | 774.325 | 71.0207 |
| 512 | **16** | 84.8949 | 15.1051 | 5.64664 | 3.57615 | 4.93043 | 773.705 | 70.9975 |
| 512 | **32** | 84.8949 | 15.1051 | 5.64664 | 3.57615 | 4.93043 | 773.705 | 70.9975 |
| 512 | **64** | 93.642 | 6.35798 | 3.38917 | 3.57615 | 3.45385 | 1104.48 | 79.6832 |
| 512 | **128** | 84.9274 | 15.0726 | 5.63776 | 3.5797 | 4.92557 | 774.468 | 71.0261 |
| 1024 | **8** | 84.8949 | 15.1051 | 5.64664 | 3.57615 | 4.93043 | 773.705 | 70.9975 |
| 1024 | **16** | 84.9274 | 15.0726 | 5.63776 | 3.5797 | 4.92557 | 774.468 | 71.0261 |
| 1024 | **32** | 84.9274 | 15.0726 | 5.63776 | 3.5797 | 4.92557 | 774.468 | 71.0261 |
| 1024 | **64** | 84.9274 | 15.0726 | 5.63776 | 3.5797 | 4.92557 | 774.468 | 71.0261 |
| 1024 | **128** | 84.9074 | 15.0926 | 5.63943 | 3.5829 | 4.92827 | 774.044 | 71.0102 |
| 2048 | **8** | 84.8949 | 15.1051 | 5.64664 | 3.57615 | 4.93043 | 773.705 | 70.9975 |
| 2048 | **16** | 84.9274 | 15.0726 | 5.63776 | 3.5797 | 4.92557 | 774.468 | 71.0261 |
| 2048 | **32** | 84.9274 | 15.0726 | 5.63776 | 3.5797 | 4.92557 | 774.468 | 71.0261 |
| 2048 | **64** | 84.9274 | 15.0726 | 5.63776 | 3.5797 | 4.92557 | 774.468 | 71.0261 |
| 2048 | **128** | 84.9074 | 15.0926 | 5.63943 | 3.5829 | 4.92827 | 774.044 | 71.0102 |
| 2048 | **256** | 84.9074 | 15.0926 | 5.63943 | 3.5829 | 4.92827 | 774.044 | 71.0102 |

表4：理想环境下各个Cache的命中率

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Size | Stride | GAM:HR(%) | DM:HR(%) | FAM:HR(%) |
| 64 | **8** | 99.8 | 99.8 | 99.8 |
| 64 | **16** | 99.9 | 99.9 | 99.9 |
| 64 | **32** | 99.9 | 99.9 | 99.9 |
| 64 | **64** | 99.9 | 99.9 | 99.9 |
| 128 | **8** | 99.6 | 99.6 | 99.6 |
| 128 | **16** | 99.8 | 99.8 | 99.8 |
| 128 | **32** | 99.9 | 99.9 | 99.9 |
| 128 | **64** | 99.9 | 99.9 | 99.9 |
| 256 | **8** | 99.2 | 99.2 | 99.2 |
| 256 | **16** | 99.6 | 99.6 | 99.6 |
| 256 | **32** | 99.8 | 99.8 | 99.8 |
| 256 | **64** | 99.9 | 99.9 | 99.9 |
| 512 | **4** | 0 | 0 | 0 |
| 512 | **8** | 0 | 0 | 98.4 |
| 512 | **16** | 0 | 0 | 99.2 |
| 512 | **32** | 99.6 | 0 | 99.6 |
| 512 | **64** | 99.8 | 0 | 99.8 |
| 512 | **128** | 99.9 | 99.9 | 99.9 |
| 1024 | **8** | 0 | 0 | 0 |
| 1024 | **16** | 0 | 0 | 98.4 |
| 1024 | **32** | 0 | 0 | 99.2 |
| 1024 | **64** | 99.6 | 0 | 99.6 |
| 1024 | **128** | 99.8 | 0 | 99.8 |
| 2048 | **8** | 0 | 0 | 0 |
| 2048 | **16** | 0 | 0 | 0 |
| 2048 | **32** | 0 | 0 | 98.4 |
| 2048 | **64** | 0 | 0 | 99.2 |
| 2048 | **128** | 99.6 | 0 | 99.6 |
| 2048 | **256** | 99.8 | 0 | 99.8 |

----------Group Associated Mapping Cache----------

Using Write Back Strategy.

Using FIFO Replacement Strategy.

4 lines in a set.

Cache parameters:

Cache Size: 1024B, Line Size: 64B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 16

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

--------------Directed Mapping Cache--------------

Using Write Back Strategy.

Cache parameters:

Cache Size: 1024B, Line Size: 64B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 16

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

----------Fully Associated Mapping Cache----------

Using Write Back Strategy.

Using FIFO Replacement Strategy.

Cache parameters:

Cache Size: 1024B, Line Size: 64B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 16

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表5

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Size | Stride | GAM:  HR(%) | DM:  HR(%) | FAM:HR(%) | Size | Stride | GAM:HR(%) | DM:  HR(%) | FAM:  HR(%) |
| 64 | **1** | 99.993 | 99.993 | 99.993 | **384** | **1** | 93.75 | 93.75 | 93.75 |
| 64 | **2** | 99.987 | 99.987 | 99.987 | **384** | **2** | 87.5 | 91.662 | 87.5 |
| 64 | **4** | 99.975 | 99.975 | 99.975 | **384** | **4** | 75.0 | 83.325 | 75.0 |
| 64 | **6** | 99.963 | 99.963 | 99.963 | **384** | **6** | 62.5 | 74.987 | 62.5 |
| 64 | **8** | 99.95 | 99.95 | 99.95 | **384** | **8** | 50.0 | 66.65 | 50.0 |
| 64 | **12** | 99.933 | 99.933 | 99.933 | **384** | **12** | 25.0 | 49.975 | 25.0 |
| 64 | **16** | 99.9 | 99.9 | 99.9 | **384** | **16** | 0 | 33.3 | 0 |
| 256 | **1** | 99.993 | 99.993 | 99.993 | **512** | **1** | 93.75 | 93.75 | 93.75 |
| 256 | **2** | 99.987 | 99.987 | 99.987 | **512** | **2** | 87.5 | 87.5 | 87.5 |
| 256 | **4** | 99.975 | 99.975 | 99.975 | **512** | **4** | 75.0 | 75.0 | 75.0 |
| 256 | **6** | 99.963 | 99.963 | 99.963 | **512** | **6** | 62.790 | 62.790 | 62.790 |
| 256 | **8** | 99.95 | 99.95 | 99.95 | **512** | **8** | 50.0 | 50.0 | 50.0 |
| 256 | **12** | 99.933 | 99.933 | 99.933 | **512** | **12** | 25.581 | 25.581 | 25.581 |
| 256 | **16** | 99.9 | 99.9 | 99.9 | **512** | **16** | 0 | 0 | 0 |

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----------Group Associated Mapping Cache----------

Using Write Back Strategy.

4 lines in a set.

Cache parameters:

Cache Size: 256B, Line Size: 16B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 4

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表6：GAMC

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| RR | **8** | 90.5696 | 9.43044 | 3.60954 | 3.3376 | 3.5916 | 1062.12 | 78.8729 |
| **16** | 92.397 | 7.60299 | 3.27105 | 2.61016 | 3.23054 | 1180.82 | 80.9968 |
| **32** | 92.6109 | 7.38908 | 3.25813 | 2.3397 | 3.20382 | 1190.67 | 81.154 |
| LFUR | **8** | 46.2502 | 53.7498 | 12.6845 | 11.9071 | 12.6332 | 301.957 | 25.6868 |
| **16** | 63.1133 | 36.8867 | 9.51651 | 3.13846 | 9.12555 | 418.024 | 46.3203 |
| **32** | 57.3954 | 42.6046 | 10.496 | 11.2567 | 10.541 | 361.891 | 37.994 |
| LRUR | **8** | 91.6207 | 8.3793 | 3.67717 | 3.43192 | 3.66099 | 1041.98 | 78.4647 |
| **16** | 92.5456 | 7.45444 | 3.45006 | 2.74381 | 3.40676 | 1119.74 | 79.9602 |
| **32** | 93.6602 | 6.33983 | 3.26232 | 2.47686 | 3.21587 | 1186.21 | 81.0831 |
| FIFOR | **8** | 90.628 | 9.372 | 3.70666 | 3.39143 | 3.68587 | 1034.95 | 78.3184 |
| **16** | 91.5501 | 8.44991 | 3.5152 | 2.5018 | 3.45308 | 1104.72 | 79.6877 |
| **32** | 92.3785 | 7.62153 | 3.39072 | 2.32115 | 3.32747 | 1146.43 | 80.4266 |

----------Fully Associated Mapping Cache----------

Using Write Back Strategy.

Cache parameters:

Cache Size: 256B, Line Size: 16B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 4

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表7：FAMC

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| RR | **8** | 89.694 | 10.306 | 3.86461 | 3.28024 | 3.82607 | 997.027 | 77.4937 |
| **16** | 90.4683 | 9.53169 | 3.71483 | 2.73899 | 3.65501 | 1043.69 | 78.4999 |
| **32** | 91.9434 | 8.05656 | 3.44811 | 2.33841 | 3.38249 | 1127.78 | 80.103 |
| LFUR | **8** | 17.9723 | 82.0277 | 27.2998 | 31.5929 | 27.5829 | 138.299 | -62.252 |
| **16** | 17.4871 | 82.5129 | 27.3937 | 31.9018 | 27.67 | 137.864 | -62.765 |
| **32** | 17.2097 | 82.7903 | 27.4559 | 31.799 | 27.7235 | 137.598 | -63.079 |
| LRUR | **8** | 89.8016 | 10.1984 | 5.29077 | 4.44216 | 5.23481 | 728.718 | 69.207 |
| **16** | 90.9 | 9.10002 | 4.96763 | 3.00318 | 4.84721 | 786.988 | 71.487 |
| **32** | 92.9313 | 7.06869 | 4.30806 | 2.47626 | 4.19973 | 908.32 | 75.2957 |
| FIFOR | **8** | 88.5247 | 11.4753 | 4.10818 | 3.05087 | 4.03846 | 944.592 | 76.2444 |
| **16** | 90.7895 | 9.21047 | 3.61904 | 3.36261 | 3.60332 | 1058.66 | 78.804 |
| **32** | 92.3405 | 7.6595 | 3.38448 | 2.2486 | 3.31731 | 1149.94 | 80.4864 |

各个参数同上，使用FIFO。ijk矩阵乘。

表8：GAMCache

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| WB | **8** | 90.628 | 9.372 | 3.70666 | 3.39143 | 3.68587 | 1034.95 | 78.3184 |
| **16** | 91.5501 | 8.44991 | 3.5152 | 2.5018 | 3.45308 | 1104.72 | 79.6877 |
| **32** | 92.3785 | 7.62153 | 3.39072 | 2.32115 | 3.32747 | 1146.43 | 80.4266 |
| WT | **8** | 90.628 | 9.372 | 3.51442 | 4.49655 | 3.57918 | 1065.8 | 78.946 |
| **16** | 91.5501 | 8.44991 | 3.40845 | 2.94425 | 3.37999 | 1128.61 | 80.1177 |
| **32** | 92.3785 | 7.62153 | 3.27609 | 2.61661 | 3.23709 | 1178.43 | 80.9583 |

表9：DMCache

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| WB | **8** | 84.9789 | 15.0211 | 6.57841 | 5.47664 | 6.50575 | 586.358 | 61.7309 |
| **16** | 91.4482 | 8.55176 | 4.61515 | 3.80302 | 4.56537 | 835.572 | 73.1449 |
| **32** | 92.3264 | 7.67362 | 4.41587 | 2.49129 | 4.30205 | 886.716 | 74.6938 |
| WT | **8** | 84.9789 | 15.0211 | 4.28946 | 18.7392 | 5.24233 | 727.672 | 69.1628 |
| **16** | 91.4482 | 8.55176 | 3.30764 | 17.9018 | 4.20224 | 907.778 | 75.281 |
| **32** | 92.3264 | 7.67362 | 3.20795 | 17.2457 | 4.0381 | 944.677 | 76.2465 |

表10：FAMCache

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| WB | **8** | 88.5247 | 11.4753 | 4.10818 | 3.05087 | 4.03846 | 944.592 | 76.2444 |
| **16** | 90.7895 | 9.21047 | 3.61904 | 3.36261 | 3.60332 | 1058.66 | 78.804 |
| **32** | 92.3405 | 7.6595 | 3.38448 | 2.2486 | 3.31731 | 1149.94 | 80.4864 |
| WT | **8** | 88.5247 | 11.4753 | 3.89501 | 3.93908 | 3.89792 | 978.651 | 77.0711 |
| **16** | 90.7895 | 9.21047 | 3.50977 | 3.78435 | 3.5266 | 1081.69 | 79.2553 |
| **32** | 92.3405 | 7.6595 | 3.28713 | 2.47535 | 3.23912 | 1177.69 | 80.9463 |

各个参数同上，使用LFU。ijk矩阵乘。

表11：GAMCache

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| WB | **8** | 46.2502 | 53.7498 | 12.6845 | 11.9071 | 12.6332 | 301.957 | 25.6868 |
| **16** | 63.1133 | 36.8867 | 9.51651 | 3.13846 | 9.12555 | 418.024 | 46.3203 |
| **32** | 57.3954 | 42.6046 | 10.496 | 11.2567 | 10.541 | 361.891 | 37.994 |
| WT | **8** | 46.2502 | 53.7498 | 11.6713 | 19.8337 | 12.2095 | 312.436 | 28.1793 |
| **16** | 63.1133 | 36.8867 | 8.99954 | 4.06718 | 8.6972 | 438.612 | 48.84 |
| **32** | 57.3954 | 42.6046 | 9.56918 | 18.9662 | 10.1249 | 376.764 | 40.4418 |

表12：DMCache

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| WB | **8** | 84.9789 | 15.0211 | 6.57841 | 5.47664 | 6.50575 | 586.358 | 61.7309 |
| **16** | 91.4482 | 8.55176 | 4.61515 | 3.80302 | 4.56537 | 835.572 | 73.1449 |
| **32** | 92.3264 | 7.67362 | 4.41587 | 2.49129 | 4.30205 | 886.716 | 74.6938 |
| WT | **8** | 84.9789 | 15.0211 | 4.28946 | 18.7392 | 5.24233 | 727.672 | 69.1628 |
| **16** | 91.4482 | 8.55176 | 3.30764 | 17.9018 | 4.20224 | 907.778 | 75.281 |
| **32** | 92.3264 | 7.67362 | 3.20795 | 17.2457 | 4.0381 | 944.677 | 76.2465 |

表13：FAMCache

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| WB | **8** | 17.9723 | 82.0277 | 27.2998 | 31.5929 | 27.5829 | 138.299 | -62.252 |
| **16** | 17.4871 | 82.5129 | 27.3937 | 31.9018 | 27.67 | 137.864 | -62.765 |
| **32** | 17.2097 | 82.7903 | 27.4559 | 31.799 | 27.7235 | 137.598 | -63.079 |
| WT | **8** | 17.9723 | 82.0277 | 26.3585 | 46.3443 | 27.583 | 138.299 | -62.253 |
| **16** | 17.4871 | 82.5129 | 26.4183 | 46.8397 | 27.6701 | 137.864 | -62.765 |
| **32** | 17.2097 | 82.7903 | 26.514 | 46.9668 | 27.7235 | 137.598 | -63.079 |

D:/trace/S32\_DRAM\_out/ijk\_S32\_DRAM.out

----------Group Associated Mapping Cache----------

Using Write Through Strategy.

Using Least Frequently Used Replacement Strategy.

4 lines in a set.

Cache parameters:

Line Size: 16B, Word Size: 4B

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表14：Cache大小对命中率的影响

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GAMCache | | DMCache | | FAMCache | |
| CS(B) | **HR(%)** | **CS(B)** | **HR(%)** | **CS(B)** | **HR(%)** |
| 64 | 17.2091 | **64** | 55.7238 | **64** | 17.2091 |
| 96 | 17.2091 | **96** | 55.7238 | **96** | 17.2092 |
| 128 | 48.3063 | **128** | 68.0151 | **128** | 17.2094 |
| 160 | 48.3063 | **160** | 68.0151 | **160** | 17.2095 |
| 192 | 48.3063 | **192** | 68.0151 | **192** | 17.2097 |
| 224 | 48.321 | **224** | 68.0151 | **224** | 17.2097 |
| 256 | 57.3954 | **256** | 92.3264 | **256** | 17.2097 |
| 288 | 57.3954 | **288** | 92.3264 | **288** | 17.2099 |
| 320 | 57.3954 | **320** | 92.3264 | **320** | 17.2108 |
| 480 | 57.3954 | **480** | 92.3264 | **480** | 17.2118 |
| 512 | 77.9183 | **512** | 94.5922 | **512** | 17.2118 |
| 544 | 77.9183 | **544** | 94.5922 | **544** | 17.2119 |
| 992 | 77.9183 | **992** | 94.5922 | **992** | 17.2601 |
| 1024 | 96.7889 | **1024** | 95.7455 | **1024** | 17.2619 |
| 2048 | 96.9852 | **2048** | 96.3346 | **2048** | 17.2803 |
| 4096 | 97.1321 | **4096** | 99.1341 | **4096** | 17.3347 |
| 8192 | 97.3438 | **8192** | 99.503 | **8192** | 48.9866 |
| 16384 | 99.9699 | **16384** | 99.9671 | **16384** | 94.7741 |

表15：Cache大小对平均读写时间的影响

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GAMCache | | DMCache | | FAMCache | |
| CS(B) | **AAT(ns)** | **CS(B)** | **AAT(ns)** | **CS(B)** | **AAT(ns)** |
| 64 | 17.7888 | **64** | 9.52848 | **64** | 17.7888 |
| 96 | 17.7888 | **96** | 9.52848 | **96** | 19.4446 |
| 128 | 11.7621 | **128** | 7.68479 | **128** | 21.1003 |
| 160 | 11.7621 | **160** | 7.68479 | **160** | 22.7561 |
| 192 | 11.7621 | **192** | 7.68479 | **192** | 24.4119 |
| 224 | 11.7621 | **224** | 7.68479 | **224** | 26.0677 |
| 256 | 10.1249 | **256** | 4.0381 | **256** | 27.7235 |
| 288 | 10.1249 | **288** | 4.0381 | **288** | 29.3792 |
| 320 | 10.1249 | **320** | 4.0381 | **320** | 31.0346 |
| 480 | 10.1249 | **480** | 4.0381 | **480** | 39.3131 |
| 512 | 6.40589 | **512** | 3.69822 | **512** | 40.9689 |
| 544 | 6.40589 | **544** | 3.69822 | **544** | 42.6246 |
| 992 | 6.40589 | **992** | 3.69822 | **992** | 65.7684 |
| 1024 | 2.59146 | **1024** | 3.52523 | **1024** | 67.4218 |
| 2048 | 2.55612 | **2048** | 3.43686 | **2048** | 120.348 |
| 4096 | 2.52961 | **4096** | 3.01694 | **4096** | 226.082 |
| 8192 | 2.49073 | **8192** | 2.9616 | **8192** | 271.202 |
| 16384 | 2.00646 | **16384** | 2.89199 | **16384** | 56.2577 |

----------Group Associated Mapping Cache----------

Using Write Back Strategy.

Using FIFO Replacement Strategy.

4 lines in a set.

Cache parameters:

Line Size: 16B, Word Size: 4B

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表16：Cache大小对Cache性能的影响

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | GAMCache | | DMCache | | FAMCache | |
| CS(B) | **HR(%)** | **AAT(ns)** | **HR(%)** | **AAT(ns)** | **HR(%)** | **AAT(ns)** |
| 64 | 65.5423 | 7.96966 | 55.7238 | 15.2828 | 65.5423 | 7.96966 |
| 128 | 78.511 | 5.74139 | 65.0151 | 11.5955 | 71.2714 | 7.05271 |
| 256 | 92.3785 | 3.32747 | 92.3264 | 4.30205 | 92.3405 | 3.31731 |
| 512 | 95.9475 | 2.68329 | 94.5922 | 3.62226 | 94.5125 | 2.92975 |
| 1024 | 96.5453 | 2.57508 | 95.7455 | 3.27622 | 98.8778 | 2.18847 |
| 2048 | 96.7421 | 2.53997 | 96.3346 | 3.66538 | 99.1004 | 2.14975 |
| 4096 | 98.6329 | 2.23558 | 99.1341 | 2.25923 | 99.1713 | 2.13723 |

----------Group Associated Mapping Cache----------

Using Write Back Strategy.

Using Least Frequently Used Replacement Strategy.

4 lines in a set.

Cache parameters:

Cache Size: 1024B, Word Size: 4B

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表17：Cache Line大小对Cache性能的影响

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | GAMCache | | DMCache | | FAMCache | |
| CLS(B) | **HR(%)** | **AAT(ns)** | **HR(%)** | **AAT(ns)** | **HR(%)** | **AAT(ns)** |
| 4 | 95.7022 | 2.78925 | 95.4819 | 3.35488 | 95.8 | 13.3618 |
| 8 | 96.96 | 2.56131 | 95.7454 | 3.27611 | 97.905 | 4.98672 |
| 16 | 96.9882 | 2.5561 | 95.7455 | 3.27622 | 98.9131 | 2.85529 |
| 32 | 96.9261 | 2.5681 | 95.5408 | 3.33768 | 95.9498 | 3.90451 |
| 64 | 96.8225 | 2.58671 | 95.2595 | 3.42212 | 96.1977 | 3.17998 |
| 128 | 95.5983 | 2.85928 | 66.3676 | 12.0897 | 95.2615 | 3.12054 |
| 256 | 86.2232 | 4.90355 | 64.751 | 12.5747 | 86.2232 | 4.90355 |

D:/trace/S32\_MEM\_out/kji\_S32\_MEM.out

表18：Cache Line大小对Cache性能的影响

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | GAMCache | | DMCache | | FAMCache | |
| CLS(B) | **HR(%)** | **AAT(ns)** | **HR(%)** | **AAT(ns)** | **HR(%)** | **AAT(ns)** |
| 4 | 88.1872 | 5.05032 | 86.7986 | 13.2014 | 92.5185 | 7.48152 |
| 8 | 88.1877 | 5.04844 | 86.4926 | 6.05162 | 95.6538 | 4.34623 |
| 16 | 88.0605 | 5.07274 | 85.8968 | 6.23066 | 87.1299 | 12.9951 |
| 32 | 87.9206 | 5.10158 | 84.7163 | 6.58495 | 87.1207 | 8.90374 |
| 64 | 87.849 | 5.11167 | 83.4488 | 6.96529 | 87.5022 | 6.67765 |
| 128 | 87.5658 | 5.17119 | 81.9526 | 7.41417 | 87.5215 | 5.68499 |
| 256 | 93.2273 | 3.7468 | 80.4194 | 7.87415 | 93.2273 | 3.7468 |

----------Group Associated Mapping Cache----------

Using Write Back Strategy.

Using Least Recently Used Replacement Strategy.

Cache parameters:

Cache Size: 1024B, Line Size: 16B, Word Size: 4B

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表19：组相联Cache中组数对Cache性能的影响

|  |  |  |
| --- | --- | --- |
|  | GAMCache | |
| SN | **HR(%)** | **AAT(ns)** |
| 1 | 85.8968 | 5.06937 |
| 2 | 86.9924 | 4.99206 |
| 4 | 88.0605 | 5.07274 |
| 8 | 87.9823 | 5.56951 |
| 16 | 87.8175 | 6.58059 |
| 32 | 87.4771 | 6.68886 |
| 64 | 87.1207 | 8.90374 |

----------Group Associated Mapping Cache----------

Using Write Back Strategy.

Using Least Recently Used Replacement Strategy.

4 lines in a set.

Cache parameters:

Cache Size: 1024B, Line Size: 64B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 16

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

--------------Directed Mapping Cache--------------

Using Write Back Strategy.

Cache parameters:

Cache Size: 1024B, Line Size: 64B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 16

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

----------Fully Associated Mapping Cache----------

Using Write Back Strategy.

Using Least Recently Used Replacement Strategy.

Cache parameters:

Cache Size: 1024B, Line Size: 64B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 16

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

D:/trace/S\*\_MEM\_out/ijk\_S\*\_MEM.out

表20：ijk矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **8** | 99.8067 | 0.1932 | 2.041 | 2.07316 | 2.04678 | 1863.76 | 87.960 |
| **16** | 95.3254 | 4.6746 | 2.99538 | 2.5175 | 2.91609 | 1308.16 | 82.846 |
| **32** | 92.0516 | 7.9484 | 3.69522 | 2.28215 | 3.46971 | 1099.43 | 79.589 |
| **64** | 91.5106 | 8.4893 | 3.81008 | 2.13797 | 3.54806 | 1075.15 | 79.129 |
| **128** | 91.1673 | 8.8326 | 3.88227 | 2.06967 | 3.60086 | 1059.39 | 78.818 |
| DM | **8** | 99.7301 | 0.2698 | 2.06739 | 2.13398 | 2.07937 | 1834.55 | 87.768 |
| **16** | 95.7103 | 4.2896 | 3.37126 | 2.86025 | 3.28647 | 1160.73 | 80.667 |
| **32** | 90.1358 | 9.8641 | 5.43591 | 2.44862 | 4.95916 | 769.222 | 70.828 |
| **64** | 90.3052 | 9.6947 | 5.40601 | 2.23046 | 4.9084 | 777.178 | 71.127 |
| **128** | 90.376 | 9.6239 | 5.39645 | 2.11621 | 4.88718 | 780.552 | 71.251 |
| FAM | **8** | 99.8094 | 0.1905 | 2.0613 | 2.10785 | 2.06967 | 1843.14 | 87.825 |
| **16** | 91.3135 | 8.6865 | 5.04783 | 2.85062 | 4.68327 | 814.537 | 72.451 |
| **32** | 91.5328 | 8.4671 | 4.9853 | 2.45989 | 4.58226 | 832.492 | 73.045 |
| **64** | 91.6548 | 8.3452 | 4.95486 | 2.23073 | 4.52799 | 842.471 | 73.364 |
| **128** | 91.7188 | 8.2812 | 4.93788 | 2.11602 | 4.49977 | 847.753 | 73.530 |

----------Group Associated Mapping Cache----------

Using Write Back Strategy.

Using Least Recently Used Replacement Strategy.

4 lines in a set.

Cache parameters:

Cache Size: 256B, Line Size: 16B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 4

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

--------------Directed Mapping Cache--------------

Using Write Back Strategy.

Cache parameters:

Cache Size: 256B, Line Size: 16B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 4

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

----------Fully Associated Mapping Cache----------

Using Write Back Strategy.

Using Least Recently Used Replacement Strategy.

Cache parameters:

Cache Size: 256B, Line Size: 16B, Word Size: 4B

Total number of lines: 16, Toal number of word in a line: 4

Cache Access Latency: 2ns, Memory Access Latency: 15ns, CPU Cycle: 1ns

表21：ijk矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **8** | 91.397 | 8.603 | 3.87064 | 3.03818 | 3.72097 | 1025.19 | 78.112 |
| **16** | 91.309 | 8.6909 | 3.87203 | 2.55418 | 3.65338 | 1044.16 | 78.509 |
| **32** | 91.1264 | 8.8736 | 3.90334 | 2.28027 | 3.64431 | 1046.76 | 78.562 |
| **64** | 89.7225 | 10.277 | 4.19979 | 2.1415 | 3.87725 | 983.866 | 77.192 |
| **128** | 89.5733 | 10.426 | 4.22254 | 2.07054 | 3.88844 | 981.037 | 77.126 |
| DM | **8** | 91.5803 | 8.4197 | 4.68648 | 3.78459 | 4.52432 | 843.153 | 73.386 |
| **16** | 88.1987 | 11.801 | 6.05513 | 2.95027 | 5.53998 | 688.576 | 67.411 |
| **32** | 88.5591 | 11.440 | 5.99184 | 2.48498 | 5.43217 | 702.242 | 68.046 |
| **64** | 88.5102 | 11.489 | 6.04133 | 2.24797 | 5.44691 | 700.342 | 67.959 |
| **128** | 87.3831 | 12.616 | 6.4592 | 2.11706 | 5.78507 | 659.404 | 65.970 |
| FAM | **8** | 95.8624 | 4.1375 | 3.48631 | 2.74719 | 3.35342 | 1137.55 | 80.274 |
| **16** | 88.7176 | 11.282 | 6.09861 | 2.94 | 5.57453 | 684.308 | 67.208 |
| **32** | 89.1756 | 10.824 | 5.89917 | 2.53365 | 5.36206 | 711.424 | 68.458 |
| **64** | 89.432 | 10.568 | 5.80363 | 2.26323 | 5.24884 | 726.769 | 69.124 |
| **128** | 89.6177 | 10.382 | 5.70461 | 2.1173 | 5.14767 | 741.054 | 69.719 |

表22：ikj矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **8** | 97.4084 | 2.5915 | 2.59123 | 2.36255 | 2.55849 | 1491 | 84.950 |
| **16** | 97.4455 | 2.5545 | 2.56335 | 2.62881 | 2.57206 | 1483.13 | 84.870 |
| **32** | 96.3652 | 3.6348 | 2.81141 | 3.69284 | 2.92482 | 1304.25 | 82.795 |
| **64** | 96.5383 | 3.4617 | 3.00732 | 2.00534 | 2.88202 | 1323.62 | 83.047 |
| **128** | 96.704 | 3.2960 | 2.95763 | 2.00134 | 2.83726 | 1344.5 | 83.310 |
| DM | **8** | 90.7139 | 9.2861 | 4.71906 | 5.17614 | 4.78451 | 797.302 | 71.855 |
| **16** | 89.5705 | 10.429 | 4.87539 | 6.77887 | 5.12851 | 743.822 | 69.832 |
| **32** | 87.7538 | 12.246 | 5.02334 | 10.0788 | 5.67377 | 672.339 | 66.624 |
| **64** | 83.7374 | 16.262 | 5.45828 | 16.661 | 6.87875 | 554.5367 | 59.536 |
| **128** | 83.3751 | 16.624 | 5.56995 | 16.831 | 6.98745 | 545.936 | 58.897 |
| FAM | **8** | 97.1304 | 2.8695 | 3.04315 | 2.72254 | 2.99725 | 1272.73 | 82.369 |
| **16** | 96.8361 | 3.1638 | 3.03633 | 3.78577 | 3.13599 | 1216.43 | 81.553 |
| **32** | 95.9562 | 4.0438 | 3.74505 | 2.02052 | 3.52317 | 1082.74 | 79.275 |
| **64** | 96.1363 | 3.8637 | 3.6505 | 2.00775 | 3.4422 | 1108.21 | 79.751 |
| **128** | 96.5324 | 3.4676 | 3.47337 | 2.04054 | 3.29301 | 1158.42 | 80.629 |

表23：kij矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **8** | 96.7817 | 3.2183 | 2.94291 | 2.23532 | 2.8416 | 1342.45 | 83.284 |
| **16** | 96.9197 | 3.0803 | 2.91015 | 2.06467 | 2.79772 | 1363.5 | 83.542 |
| **32** | 96.3689 | 3.631 | 3.02796 | 2.01392 | 2.8975 | 1316.55 | 82.955 |
| **64** | 96.5366 | 3.4634 | 2.99357 | 2.00534 | 2.86827 | 1329.97 | 83.127 |
| **128** | 96.704 | 3.2960 | 2.94943 | 2.00134 | 2.83008 | 1347.91 | 83.352 |
| DM | **8** | 90.725 | 9.275 | 4.71555 | 5.17381 | 4.78116 | 797.86 | 71.875 |
| **16** | 89.3923 | 10.607 | 4.93713 | 6.77821 | 5.18195 | 736.151 | 69.517 |
| **32** | 86.8658 | 13.134 | 5.32908 | 10.0788 | 5.94018 | 642.186 | 65.057 |
| **64** | 82.7571 | 17.242 | 5.79509 | 16.661 | 7.17285 | 531.824 | 57.806 |
| **128** | 83.4203 | 16.579 | 5.55443 | 16.831 | 6.97389 | 546.997 | 58.977 |
| FAM | **8** | 96.4758 | 3.5241 | 3.50251 | 2.44882 | 3.35164 | 1138.16 | 80.284 |
| **16** | 96.6096 | 3.3904 | 3.47952 | 2.09189 | 3.295 | 1157.72 | 80.617 |
| **32** | 95.9562 | 4.0438 | 3.71412 | 2.02052 | 3.49622 | 1091.09 | 79.434 |
| **64** | 96.1362 | 3.8637 | 3.63442 | 2.00775 | 3.42816 | 1112.75 | 79.834 |
| **128** | 96.5324 | 3.4676 | 3.46516 | 2.04054 | 3.28583 | 1160.95 | 80.671 |

表24：kji矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **8** | 88.1295 | 11.870 | 5.44656 | 2.22598 | 4.98544 | 765.167 | 70.673 |
| **16** | 87.2613 | 12.738 | 5.70348 | 2.11354 | 5.2261 | 729.932 | 69.258 |
| **32** | 87.1629 | 12.837 | 5.72486 | 2.05027 | 5.25209 | 726.32 | 69.105 |
| **64** | 87.0623 | 12.937 | 5.73598 | 2.10313 | 5.27535 | 723.118 | 68.968 |
| **128** | 87.2589 | 12.741 | 5.68885 | 2.09548 | 5.23653 | 728.478 | 69.196 |
| DM | **8** | 86.6699 | 13.330 | 5.69843 | 7.78849 | 5.99768 | 636.029 | 64.719 |
| **16** | 82.7186 | 17.281 | 7.31111 | 6.35585 | 7.18408 | 530.993 | 57.740 |
| **32** | 83.1095 | 16.890 | 7.33079 | 5.28117 | 7.06709 | 539.784 | 58.428 |
| **64** | 83.3251 | 16.674 | 7.34382 | 4.65161 | 7.00246 | 544.766 | 58.809 |
| **128** | 84.079 | 15.920 | 7.07905 | 4.67228 | 6.7761 | 562.964 | 60.140 |
| FAM | **8** | 85.7691 | 14.230 | 8.14383 | 2.34785 | 7.31398 | 521.563 | 56.976 |
| **16** | 85.7107 | 14.289 | 8.11988 | 2.09453 | 7.31865 | 521.229 | 56.949 |
| **32** | 85.6269 | 14.373 | 8.11672 | 2.02136 | 7.33249 | 520.246 | 56.867 |
| **64** | 85.5873 | 14.412 | 8.11369 | 2.0078 | 7.33948 | 519.75 | 56.826 |
| **128** | 86.5734 | 13.426 | 7.71778 | 2.00225 | 6.99833 | 545.087 | 58.833 |

表25：jik矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **8** | 90.5207 | 9.4792 | 4.04915 | 3.08888 | 3.8765 | 984.057 | 77.197 |
| **16** | 89.9789 | 10.021 | 4.15369 | 2.55594 | 3.88859 | 980.997 | 77.125 |
| **32** | 89.7583 | 10.241 | 4.19552 | 2.27766 | 3.88945 | 980.782 | 77.120 |
| **64** | 89.5965 | 10.403 | 4.22708 | 2.14152 | 3.90027 | 978.059 | 77.057 |
| **128** | 89.6127 | 10.387 | 4.21425 | 2.07054 | 3.88143 | 982.807 | 77.168 |
| DM | **8** | 91.4463 | 8.5536 | 4.73247 | 3.78459 | 4.56451 | 835.731 | 73.15 |
| **16** | 87.2331 | 12.766 | 6.40242 | 2.95027 | 5.82965 | 654.362 | 65.708 |
| **32** | 87.3127 | 12.687 | 6.43677 | 2.48498 | 5.8061 | 657.016 | 65.846 |
| **64** | 87.3301 | 12.669 | 6.46116 | 2.24797 | 5.80095 | 657.599 | 65.876 |
| **128** | 87.4386 | 12.561 | 6.43948 | 2.11706 | 5.76841 | 661.308 | 66.068 |
| FAM | **8** | 92.6831 | 7.3168 | 4.5077 | 4.09425 | 4.43336 | 860.453 | 73.921 |
| **16** | 89.117 | 10.883 | 5.96071 | 2.91095 | 5.4547 | 699.341 | 67.913 |
| **32** | 89.4107 | 10.589 | 5.81668 | 2.52191 | 5.29086 | 720.997 | 68.877 |
| **64** | 89.554 | 10.446 | 5.76381 | 2.23975 | 5.21159 | 731.964 | 69.343 |
| **128** | 89.6796 | 10.320 | 5.68216 | 2.11913 | 5.12898 | 743.753 | 69.829 |

表26：jki矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **8** | 88.1128 | 11.887 | 5.44535 | 2.22155 | 4.98377 | 765.424 | 70.683 |
| **16** | 87.260 | 12.739 | 5.70592 | 2.10189 | 5.22667 | 729.852 | 69.254 |
| **32** | 87.1226 | 12.877 | 5.73273 | 2.05495 | 5.25955 | 725.29 | 69.061 |
| **64** | 87.0772 | 12.922 | 5.74461 | 2.0226 | 5.27268 | 723.483 | 68.984 |
| **128** | 87.2792 | 12.720 | 5.69783 | 2.00324 | 5.23277 | 729.002 | 69.219 |
| DM | **8** | 87.653 | 12.384 | 5.36703 | 7.79083 | 5.71407 | 667.597 | 66.387 |
| **16** | 82.7241 | 17.275 | 7.30908 | 6.35651 | 7.18241 | 531.116 | 57.750 |
| **32** | 83.1122 | 16.887 | 7.32982 | 5.28138 | 7.06627 | 539.846 | 58.433 |
| **64** | 83.3264 | 16.673 | 7.34334 | 4.6517 | 7.00205 | 544.797 | 58.811 |
| **128** | 84.0797 | 15.920 | 7.07905 | 4.67229 | 6.7761 | 562.964 | 60.140 |
| FAM | **8** | 85.7786 | 14.221 | 8.14042 | 2.3496 | 7.3113 | 521.753 | 56.992 |
| **16** | 85.712 | 14.288 | 8.1194 | 2.09486 | 7.31828 | 521.256 | 56.951 |
| **32** | 85.6271 | 14.372 | 8.11671 | 2.02096 | 7.33243 | 520.25 | 56.868 |
| **64** | 85.5873 | 14.412 | 8.11368 | 2.00783 | 7.33948 | 519.75 | 56.826 |
| **128** | 86.5735 | 13.426 | 7.71777 | 2.00218 | 6.99831 | 545.088 | 58.833 |

表27：转置矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **8** | 96.8891 | 3.1109 | 2.70781 | 2.51804 | 2.67329 | 1426.97 | 84.274 |
| **16** | 96.5937 | 34063 | 2.77569 | 2.37679 | 2.70891 | 1408.2 | 84.065 |
| **32** | 95.433 | 4.5670 | 3.00689 | 2.27527 | 2.88951 | 1320.19 | 83.002 |
| **64** | 95.7536 | 4.2463 | 2.92653 | 2.143 | 2.8034 | 1360.74 | 83.509 |
| **128** | 95.9526 | 4.0473 | 2.87032 | 2.07187 | 2.74618 | 1389.09 | 83.846 |
| DM | **8** | 92.3598 | 7.6401 | 4.40552 | 3.77375 | 4.26061 | 889.081 | 74.761 |
| **16** | 90.5985 | 9.4014 | 5.17832 | 3.03809 | 4.82003 | 791.425 | 71.646 |
| **32** | 88.1669 | 11.833 | 6.12122 | 2.55967 | 5.54983 | 687.35 | 67.353 |
| **64** | 82.7466 | 17.253 | 8.08603 | 2.29479 | 7.17598 | 531.593 | 57.788 |
| **128** | 82.7795 | 17.220 | 8.09127 | 2.14114 | 7.16615 | 532.322 | 57.846 |
| FAM | **8** | 96.7417 | 3.2582 | 3.18931 | 2.71377 | 3.10281 | 1229.43 | 81.748 |
| **16** | 96.1574 | 3.8426 | 3.4199 | 2.49562 | 3.26517 | 1168.3 | 80.793 |
| **32** | 95.1183 | 4.8816 | 3.79502 | 2.44931 | 3.57913 | 1065.82 | 78.946 |
| **64** | 95.5076 | 4.4924 | 3.63271 | 2.23195 | 3.41259 | 1117.83 | 79.925 |
| **128** | 95.7472 | 4.2528 | 3.52057 | 2.11663 | 3.30229 | 1155.17 | 80.574 |

表28：分块转置矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **8** | 96.9262 | 3.0738 | 2.70555 | 2.46724 | 2.66249 | 1432.76 | 84.338 |
| **16** | 96.5791 | 3.4208 | 2.78076 | 2.37924 | 2.71368 | 1405.73 | 84.037 |
| **32** | 95.4265 | 4.5735 | 3.01067 | 2.27259 | 2.89234 | 1318.9 | 82.986 |
| **64** | 95.7488 | 4.2512 | 2.92916 | 2.14103 | 2.80534 | 1359.8 | 83.498 |
| **128** | 95.9506 | 4.0493 | 2.87157 | 2.07169 | 2.74721 | 1388.57 | 83.839 |
| DM | **8** | 92.169 | 7.831 | 4.43894 | 3.93497 | 4.34787 | 877.371 | 74.424 |
| **16** | 90.5443 | 9.4557 | 5.18504 | 3.09745 | 4.83631 | 788.763 | 71.551 |
| **32** | 88.1396 | 11.860 | 6.12539 | 2.58655 | 5.55802 | 686.341 | 67.305 |
| **64** | 82.7388 | 17.261 | 8.08613 | 2.30787 | 7.17833 | 531.419 | 57.774 |
| **128** | 82.7756 | 17.224 | 8.09131 | 2.14791 | 7.16731 | 532.236 | 57.839 |
| FAM | **8** | 96.753 | 3.2470 | 3.20138 | 2.64779 | 3.10135 | 1230.01 | 81.756 |
| **16** | 96.1709 | 3.8291 | 3.40979 | 2.50249 | 3.25822 | 1170.79 | 80.834 |
| **32** | 95.1576 | 4.8424 | 3.77224 | 2.45909 | 3.5617 | 1071.03 | 79.048 |
| **64** | 95.5292 | 4.4708 | 3.62008 | 2.23846 | 3.40302 | 1120.98 | 79.982 |
| **128** | 95.7599 | 4.2401 | 3.51376 | 2.12011 | 3.2971 | 1156.99 | 80.605 |

表29：分块矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Size | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **8** | 90.9579 | 9.0420 | 4.09704 | 2.22052 | 3.7964 | 104.82 | 77.668 |
| **16** | 91.6596 | 8.3403 | 3.92486 | 2.05733 | 3.6323 | 1050.21 | 78.633 |
| **32** | 91.7096 | 8.2904 | 3.9144 | 2.0117 | 3.61803 | 1054.36 | 78.717 |
| **64** | 91.7154 | 8.2845 | 3.91311 | 2.00441 | 3.61611 | 1054.92 | 78.728 |
| **128** | 91.9471 | 8.0529 | 3.8795 | 2.00154 | 3.58741 | 1063.36 | 78.897 |
| DM | **8** | 90.3175 | 9.6825 | 5.38842 | 2.36076 | 4.90335 | 777.978 | 71.156 |
| **16** | 87.9597 | 12.040 | 6.25074 | 2.17161 | 5.61173 | 679.773 | 66.989 |
| **32** | 88.3079 | 11.692 | 6.13395 | 2.11258 | 5.50756 | 692.629 | 67.602 |
| **64** | 88.5295 | 11.470 | 6.05679 | 2.1002 | 5.44112 | 701.087 | 67.993 |
| **128** | 88.732 | 11.268 | 5.98533 | 2.09597 | 5.38038 | 709.002 | 68.350 |
| FAM | **8** | 93.0001 | 6.9998 | 4.60472 | 2.33001 | 4.24028 | 899.633 | 75.057 |
| **16** | 93.1947 | 6.8052 | 4.53286 | 2.15544 | 4.16043 | 916.9 | 75.526 |
| **32** | 93.6852 | 6.3148 | 4.36893 | 2.01853 | 4.00282 | 935.003 | 76.454 |
| **64** | 93.6938 | 6.3062 | 4.36655 | 2.00683 | 3.99936 | 953.827 | 76.474 |
| **128** | 96.0735 | 3.9265 | 3.4849 | 2.05115 | 3.2619 | 1169.47 | 80.812 |

表30：分块矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BS | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **4** | 91.9779 | 8.0220 | 4.01718 | 2.00635 | 3.67415 | 1038.25 | 78.387 |
| **8** | 92.037 | 7.9630 | 3.86036 | 2.00092 | 3.57116 | 1068.2 | 78.993 |
| **16** | 92.1115 | 7.8885 | 3.75587 | 2.00056 | 3.49414 | 1091.74 | 79.446 |
| **32** | 91.9632 | 8.0367 | 3.74347 | 2.0006 | 3.48899 | 1093.35 | 79.476 |
| **64** | 90.7072 | 9.2928 | 3.98627 | 2.00061 | 3.69945 | 1031.15 | 78.238 |
| **128** | 90.5738 | 9.4262 | 4.00356 | 2.00062 | 3.71581 | 1026.61 | 78.142 |
| DM | **4** | 88.9566 | 11.043 | 5.93434 | 2.29225 | 5.31303 | 717.989 | 68.746 |
| **8** | 88.6377 | 11.362 | 6.00206 | 2.18697 | 5.4087 | 705.29 | 68.184 |
| **16** | 88.4406 | 11.559 | 6.2523 | 2.10439 | 5.46782 | 697.663 | 67.836 |
| **32** | 88.3442 | 11.655 | 6.08502 | 2.05586 | 5.49673 | 693.993 | 67.666 |
| **64** | 88.0925 | 11.907 | 6.17045 | 2.02921 | 5.57225 | 684.588 | 67.222 |
| **128** | 87.0578 | 12.942 | 6.53146 | 2.01524 | 5.88265 | 648.465 | 65.396 |
| FAM | **4** | 96.5001 | 3.4999 | 3.47679 | 2.07118 | 3.237 | 1178.47 | 80.958 |
| **8** | 96.1473 | 3.8526 | 3.46363 | 2.00074 | 3.2361 | 1178.79 | 80.964 |
| **16** | 89.0761 | 10.923 | 6.07796 | 2.00599 | 5.47079 | 697.285 | 67.818 |
| **32** | 89.3818 | 10.618 | 5.91235 | 2.0012 | 5.34129 | 714.19 | 68.580 |
| **64** | 89.5569 | 10.443 | 5.82402 | 2.00098 | 5.27179 | 723.606 | 68.989 |
| **128** | 89.6325 | 10.367 | 5.78347 | 2.00092 | 5.24006 | 727.987 | 69.176 |

S1 : cache size = 256B, cache line size = 16B, lines in a set = 4

S2: cache size = 512B, cache line size = 32B, lines in a set = 8

S2: cache size = 1024B, cache line size = 64B, lines in a set = 16

表31：分块矩阵乘下Cache性能指标

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | S | HR(%) | MR(%) | ART(ns) | AWT(ns) | AAT(ns) | TP(MB/s) | SUR(%) |
| GAM | **S1** | 90.8348 | 9.1652 | OFB | 2.00009 | OFB | OFB | OFB |
| **S2** | 91.7416 | 8.2583 | OFB | 2.00002 | OFB | OFB | OFB |
| **S3** | 91.6616 | 8.3383 | OFB | 2.0003 | OFB | OFB | OFB |
| DM | **S1** | 89.201 | 10.799 | OFB | 2.10591 | OFB | OFB | OFB |
| **S2** | 92.0397 | 7.9602 | OFB | 2.05294 | OFB | OFB | OFB |
| **S3** | 92.427 | 7.5721 | OFB | 2.05291 | OFB | OFB | OFB |
| FAM | **S1** | 89.1551 | 10.844 | OFB | 2.00551 | OFB | OFB | OFB |
| **S2** | 91.2231 | 8.7786 | OFB | 2.00002 | OFB | OFB | OFB |
| **S3** | 91.6616 | 8.3383 | OFB | 2.0003 | OFB | OFB | OFB |

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