

Benchmarking Output – Multicore – Matmul

512x512x512

```
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ g++ -O3 -march=native -funroll-loops -fopenmp matmul_phase2.cpp -o matmul_phase2
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 512 x 512 x 512
Threads: 1

Naive (OMP): 0.430499 s => 0.623545 GFLOPS
Loop-Interchanged (OMP): 0.0290956 s => 9.22599 GFLOPS
Transpose-B (OMP): 0.087135 s => 3.08068 GFLOPS
Blocked-Naive (OMP): 0.0277183 s => 9.68443 GFLOPS
Blocked-Interchanged (OMP): 0.0289577 s => 9.2699 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```
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```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 512 x 512 x 512
Threads: 2

Naive (OMP): 0.201075 s => 1.335 GFLOPS
Loop-Interchanged (OMP): 0.0144484 s => 18.5789 GFLOPS
Transpose-B (OMP): 0.0433299 s => 6.19516 GFLOPS
Blocked-Naive (OMP): 0.0157601 s => 17.0326 GFLOPS
Blocked-Interchanged (OMP): 0.015707 s => 17.0902 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```
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hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 512 x 512 x 512
Threads: 4

Naive (OMP): 0.151028 s => 1.77739 GFLOPS
Loop-Interchanged (OMP): 0.0118548 s => 22.6436 GFLOPS
Transpose-B (OMP): 0.024315 s => 11.0399 GFLOPS
Blocked-Naive (OMP): 0.00698269 s => 38.443 GFLOPS
Blocked-Interchanged (OMP): 0.00686053 s => 39.1275 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```
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hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 512 x 512 x 512
Threads: 8

Naive (OMP): 0.07611 s => 3.52694 GFLOPS
Loop-Interchanged (OMP): 0.0104571 s => 25.6702 GFLOPS
Transpose-B (OMP): 0.0257111 s => 10.4405 GFLOPS
Blocked-Naive (OMP): 0.00944918 s => 28.4083 GFLOPS
Blocked-Interchanged (OMP): 0.00850511 s => 31.5617 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```

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hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2

Phase 2: OpenMP Parallel Benchmarking
Matrix: 512 x 512 x 512
Threads: 12

Naive (OMP): 0.12679 s => 2.11716 GFLOPS
Loop-Interchanged (OMP): 0.00956351 s => 28.0687 GFLOPS
Transpose-B (OMP): 0.0242039 s => 11.0906 GFLOPS
Blocked-Naive (OMP): 0.00882337 s => 30.4232 GFLOPS
Blocked-Interchanged (OMP): 0.00950865 s => 28.2307 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK

```

```

sidharth@Personal:/mnt/c/Users/sidha/Downloads$ g++ -O3 -march=native -funroll-loops -std=c++17 -fopenmp matmul_multicore.cpp -o matmul_multicore
sidharth@Personal:/mnt/c/Users/sidha/Downloads$ ./matmul_multicore

Phase 2: OpenMP Parallel Benchmarking
Matrix: 512 x 512 x 512
Threads: 16

Naive (OMP): 0.109296 s => 2.45604 GFLOPS
Loop-Interchanged (OMP): 0.0284359 s => 9.44004 GFLOPS
Transpose-B (OMP): 0.0449873 s => 5.96692 GFLOPS
Blocked-Naive (OMP): 0.0226671 s => 11.8425 GFLOPS
Blocked-Interchanged (OMP): 0.0289733 s => 12.7989 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK

```

1024x1024x1024

```

hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ g++ -O3 -march=native -funroll-loops -fopenmp matmul_phase2.cpp -o matmul_phase2
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2

Phase 2: OpenMP Parallel Benchmarking
Matrix: 1024 x 1024 x 1024
Threads: 1

Naive (OMP): 7.90582 s => 0.271633 GFLOPS
Loop-Interchanged (OMP): 0.360367 s => 5.95916 GFLOPS
Transpose-B (OMP): 0.917084 s => 2.34164 GFLOPS
Blocked-Naive (OMP): 0.250562 s => 8.57068 GFLOPS
Blocked-Interchanged (OMP): 0.263658 s => 8.14496 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$

```

```

hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ g++ -O3 -march=native -funroll-loops -fopenmp matmul_phase2.cpp -o matmul_phase2
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2

Phase 2: OpenMP Parallel Benchmarking
Matrix: 1024 x 1024 x 1024
Threads: 2

Naive (OMP): 2.91661 s => 0.736295 GFLOPS
Loop-Interchanged (OMP): 0.151831 s => 14.1439 GFLOPS
Transpose-B (OMP): 0.401701 s => 5.34597 GFLOPS
Blocked-Naive (OMP): 0.13147 s => 16.3344 GFLOPS
Blocked-Interchanged (OMP): 0.136172 s => 15.7703 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK

```

```
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hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 1024 x 1024 x 1024
Threads: 8

Naive (OMP): 1.27201 s => 1.68826 GFLOPS
Loop-Interchanged (OMP): 0.0769386 s => 27.9117 GFLOPS
Transpose-B (OMP): 0.140928 s => 15.2381 GFLOPS
Blocked-Naive (OMP): 0.0722589 s => 29.7193 GFLOPS
Blocked-Interchanged (OMP): 0.0623291 s => 34.454 GFLOPS
```

```
Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ g++ -O3 -march=native -funroll-loops -fopenmp matmul_phase2.cpp -o matmul_phase2
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 1024 x 1024 x 1024
Threads: 12

Naive (OMP): 1.00984 s => 2.12656 GFLOPS
Loop-Interchanged (OMP): 0.0722399 s => 29.7271 GFLOPS
Transpose-B (OMP): 0.155961 s => 13.7693 GFLOPS
Blocked-Naive (OMP): 0.0658618 s => 32.6059 GFLOPS
Blocked-Interchanged (OMP): 0.0673566 s => 31.8823 GFLOPS
```

```
Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```
sidharth@Personal:/mnt/c/Users/sidha/Downloads$ g++ -O3 -march=native -funroll-loops -std=c++17 -fopenmp matmul_multicore.cpp -o matmul_multicore
sidharth@Personal:/mnt/c/Users/sidha/Downloads$ ./matmul_multicore
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 1024 x 1024 x 1024
Threads: 16

Naive (OMP): 0.766689 s => 2.80099 GFLOPS
Loop-Interchanged (OMP): 0.10615 s => 20.2306 GFLOPS
Transpose-B (OMP): 0.199508 s => 10.7639 GFLOPS
Blocked-Naive (OMP): 0.0736951 s => 29.1401 GFLOPS
Blocked-Interchanged (OMP): 0.0899424 s => 23.8762 GFLOPS
```

```
Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

2048x2048x2048

```
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ g++ -O3 -march=native -funroll-loops -fopenmp matmul_phase2.cpp -o matmul_phase2
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 2048 x 2048 x 2048
Threads: 1

Naive (OMP): 188.03 s => 0.0913679 GFLOPS
Loop-Interchanged (OMP): 4.97403 s => 3.45391 GFLOPS
Transpose-B (OMP): 7.84569 s => 2.18972 GFLOPS
Blocked-Naive (OMP): 3.08518 s => 5.56851 GFLOPS
Blocked-Interchanged (OMP): 2.99431 s => 5.7375 GFLOPS
```

```
Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ g++ -O3 -march=native -funroll-loops -fopenmp matmul_phase2.cpp -o matmul_phase2
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 2048 x 2048 x 2048
Threads: 2

Naive (OMP): 76.0883 s => 0.225789 GFLOPS
Loop-Interchanged (OMP): 2.51042 s => 6.84343 GFLOPS
Transpose-B (OMP): 3.60926 s => 4.75994 GFLOPS
Blocked-Naive (OMP): 1.17562 s => 14.6134 GFLOPS
Blocked-Interchanged (OMP): 1.16507 s => 14.7458 GFLOPS
```

```
Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ g++ -O3 -march=native -funroll-loops -fopenmp matmul_phase2.cpp -o matmul_phase2
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 2048 x 2048 x 2048
Threads: 4

Naive (OMP): 37.4821 s => 0.458348 GFLOPS
Loop-Interchanged (OMP): 1.20141 s => 14.2998 GFLOPS
Transpose-B (OMP): 0.161031 s => 106.687 GFLOPS
Blocked-Naive (OMP): 1.01687 s => 16.8949 GFLOPS
Blocked-Interchanged (OMP): 0.964814 s => 17.8064 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ g++ -O3 -march=native -funroll-loops -fopenmp matmul_phase2.cpp -o matmul_phase2
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 2048 x 2048 x 2048
Threads: 8

Naive (OMP): 33.0033 s => 0.52055 GFLOPS
Loop-Interchanged (OMP): 0.926408 s => 18.5446 GFLOPS
Transpose-B (OMP): 1.04045 s => 16.512 GFLOPS
Blocked-Naive (OMP): 0.676268 s => 25.4039 GFLOPS
Blocked-Interchanged (OMP): 0.714906 s => 24.0309 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ g++ -O3 -march=native -funroll-loops -fopenmp matmul_phase2.cpp -o matmul_phase2
hp@LAPTOP-2K8KFS81:/mnt/c/Users/hp/Downloads$ ./matmul_phase2
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 2048 x 2048 x 2048
Threads: 12

Naive (OMP): 32.1118 s => 0.535002 GFLOPS
Loop-Interchanged (OMP): 1.01884 s => 16.8622 GFLOPS
Transpose-B (OMP): 1.11966 s => 15.3438 GFLOPS
Blocked-Naive (OMP): 0.565999 s => 30.3532 GFLOPS
Blocked-Interchanged (OMP): 0.546982 s => 31.4085 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```

```
sidharth@Personal:/mnt/c/Users/sidha/Downloads$ g++ -O3 -march=native -funroll-loops -std=c++17 -fopenmp matmul_multicore.cpp -o matmul_multicore
sidharth@Personal:/mnt/c/Users/sidha/Downloads$ ./matmul_multicore
```

```
Phase 2: OpenMP Parallel Benchmarking
Matrix: 2048 x 2048 x 2048
Threads: 16

Naive (OMP): 14.0632 s => 1.22162 GFLOPS
Loop-Interchanged (OMP): 1.36947 s => 12.5449 GFLOPS
Transpose-B (OMP): 2.26829 s => 7.57395 GFLOPS
Blocked-Naive (OMP): 0.7511 s => 22.8729 GFLOPS
Blocked-Interchanged (OMP): 0.752558 s => 22.8286 GFLOPS

Correctness Check vs Naive:
Loop-Interchanged: OK
Transpose-B: OK
Blocked-Naive: OK
Blocked-Interchanged: OK
```