

Parallelization of the Riemann Zeta Function

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1 Introduction

This report analyzes the parallelization of the Riemann Zeta function computation using static and dynamic block-cyclic distribution with C++11 threads. We computed $\zeta(2)$ for $n = 2048$ values using 8 threads with various chunk sizes.

2 Results

Distribution	Execution Time (seconds)			
	Chunk 1	Chunk 2	Chunk 4	Chunk 8
Sequential	38.025			
Static	5.286	5.267	5.297	5.433
Dynamic	5.174	5.262	5.239	5.362

Table 1: Execution times comparison

3 Analysis

- Both methods achieved approximately $7\times$ speedup over sequential execution
- Dynamic distribution slightly outperformed static distribution across all chunk sizes
- Smaller chunk sizes (1 and 2) performed better than larger ones (4 and 8)
- Best performance: Dynamic distribution with chunk size 1 (5.174s, $7.35\times$ speedup)

4 Conclusion

Dynamic block-cyclic distribution with chunk size 1 provided the best performance for the Riemann Zeta function computation. This approach better han-

dled the inherent load imbalance caused by the $O(k^2)$ complexity, as computations with larger k values require significantly more time than those with smaller values. Despite the synchronization overhead, dynamic distribution's ability to adaptively assign work resulted in more efficient resource utilization.