Highlights
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Revisiting the Parallel Strategy for DOACROSS Loops

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Research Problem

- **DOACROSS loops** are **hot spots** in many scientific and engineering applications.

  Due to complicated loop-carried dependences, only **pipeline/wave-front parallelism** can be achieved through loop transformations.

- Existing parallel strategies for DOACROSS loops are generally **static**, which means each thread could only execute fixed allocated tasks of loop iterations.

  These static parallel strategies suffer **threads waiting** at **synchronous communication** among parallel threads and cause **waste of computing resources**.

Kernel Contribution

- We propose a brand-new **dynamic parallel strategy** for DOACROSS loops, which can effectively **avoid idle state of threads** and **optimize synchronization** in pipeline/wave-front parallelism.
- We define a dependence preservation constraint to **reduce redundant dependences and communication** based on **loop tiling** technology.
- We propose a simple and effective **tile size selection (TSS) approach** to make use of hierarchical caches for better data reuse.

Results

- The proposed parallel strategy shows **good and stable speedups and scalability** over different kinds of benchmarks on a multi-core platform.
- Our parallel strategy **outperforms** 2 typical static parallel strategies and shows **better performance** than another dynamic parallel strategy.
- The proposed TSS approach achieves **near optimal performance** and is **comparable with a state-of-the-art** analytical TSS model.