OVPM: an Out-of-Order (OoO) Vector Processing Mechanism

**Background and Purpose**

### OVPM: an Out-of-Order (OoO) Vector Processing Mechanism

**MultiMedia Applications (MMAs)**
- Music Players
- Games
- Animations
- Recognition

Next generation MMAs are required to have:
- Higher quality of media processing
- Use more computational-intensive algorithms
- Process larger data sets
- More Varieties of MMAs
- Execute various MMAs on the same platform

**Features of Next Generation MMAs**
- Plenty of data level parallelism (DLP)
- Various vector length
- Large amounts of data transmission

**Research Targets**
- To improve high computing power by using DLP
- Focus on Vector Architectures
- To improve the data transmission ability
- Focus on Memory Sub-system

**Issues of Conventional Approaches**
- Difficult to efficiently execute MMAs of various vector length
- Inefficient for MMAs with short vectors
- High power is consumed to achieve high data transmission ability

**Proposal of this Research**
- Out-of-order vector processing mechanism
- Improve the performance of vector architecture on short vector processing
- Multi-banked cache memory
- Obtain a high capability of data transmission with lower power consumption

**OVPM-Cache: A High Bandwidth Cache System**

**Features of MVP-cache**
- Achieve high bandwidth by accessing multiple independent banks concurrently
- Hide the access latencies by using the interleaved memory access method
- Large overheads on increasing the memory bandwidth

**Costs of Increasing Memory Bandwidth**

**Impacts of Cache Bandwidth**
- Relative performance is normalized by 1 bank
- Most of MMAs are sensitive to cache bandwidth
- The higher cache hit rate is, the more performance is improved

**Experimental Setup**
- Simulator development
- SimpleScalar Toolset
- ALPbench Benchmark Suite

**Benchmarks**
- sphinx3, facet3ec, raytrace, vips, MxM, VxM

**Impacts of OVPM**
- The computational efficiency of IVPM achieves 17%, while that of OVPM achieves 55.2%
- The computational efficiencies improve, especially for the MMAs with short vectors
- Both of MMAs with short vectors and long vectors achieve high utilization of hardware

**MVP-cache: A High Bandwidth Cache System**

**Impacts of Cache Bandwidth**

**Performance Evaluation of MVP-cache**

**MVP-cache bridges the gap between main memory and OVPM**

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