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1/11 5-12 Oct 2008 Differential Equations. Function Spaces. Approximation Theory.



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Agenda

- •Overview of sparse BLAS
- Performance of different formats
- Performance factors
- •Summary

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Sparse Matrix Storage formats

Intel® Math Kernel Library (Intel® MKL) supports 6 sparse matrix storage format (CSR, CSC, COO, DIA, SKY, BSR):

COO: The coordinate format is the most flexible and simplest format for the sparse matrix representation. Only nonzero entries are provided, and the coordinates of each nonzero entry are given explicitly.



CSR: Compress Sparse Row format - The compression of the non-zeros of a sparse matrix A into a linear array is done by walking across each row in order, and writing the non-zero elements to a linear array.

BSR: This format is similar to the CSR format. Nonzero entries in the BSR are square dense blocks.

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Sparse BLAS functionality

Intel® MKL Sparse BLAS is a group of computational kernels optimized for Intel architectures that perform operations:

1. Sparse matrix-vector/matrix-matrix product:

C <- alpha* op(A)* B + beta * C or

C <- op(A)* B (Level 2 only)</pre>

2. Solving a triangular system

C <- alpha*inverse of (op(A)) B or

C <- inverse of (op(A)) B (Level 2 only)

where C and B are dense matrices or vectors, A is a sparse matrix, *alpha* and *beta* are scalars, *op(A)* is one of the possible operations:

op(A)=A or op(A)= transpose of A.

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Scaling of sparse matrix-matrix multiply



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Performance of symmetric matrix-vector multiplication



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Performance of symmetric matrix-vector multiplication (+converters)



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Performance factors

Hardware characteristics (cache size, FSB bandwidth and etc) impact on the performance of Sparse BLAS routines.

Proper choice of sparse matrix format can increase performance and scalability of your application.

- Memory bandwidth plays important role and impacts on performance and scalability of your application.
- Good matrix structure (matrix bandwidth, sparsity, ...) can increase the performance of application.



Thus, Intel® MKL Sparse BLAS:

Support for wide range of sparse formats and operations
Optimization for Intel platforms
Open MP support
Static and dynamic



Efficient and fast solution for highperformance application design

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