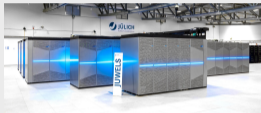# Math libraries on AMD Rome

November 30, 2020 | Sebastian Achilles | SimLab Quantum Materials (JSC)

AMD Rome at JSC

JUWELS Booster

- 936 nodes
- 2× AMD EPYC Rome 7402, 2× 24 cores, 2.7 GHz
- 512 GB DDR4
- 4× NVIDIA A100
- 4× InfiniBand HDR200

JURECA-DC

- 768 nodes
- 2× AMD EPYC Rome 7742, 2× 64 cores, 2.25 GHz
- 512 GB DDR4
- 2× InfiniBand HDR200
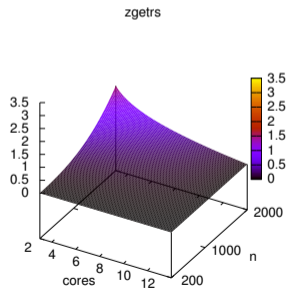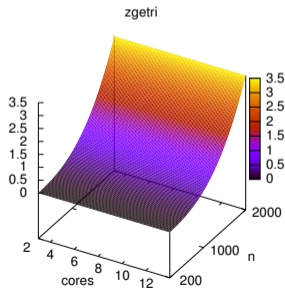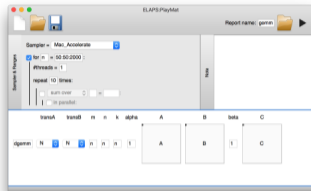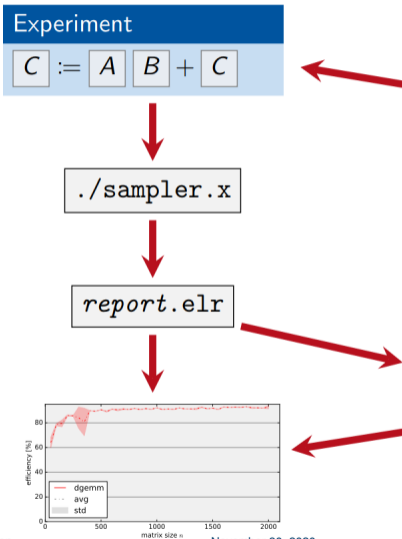- 192 nodes with 4× NVIDIA A100

JUSUF

- 205 nodes
- 2× AMD EPYC Rome 7742, 2× 64 cores, 2.25 GHz
- 256 GB DDR4
- InfiniBand HDR100
- 61 nodes with 1× NVIDIA V100
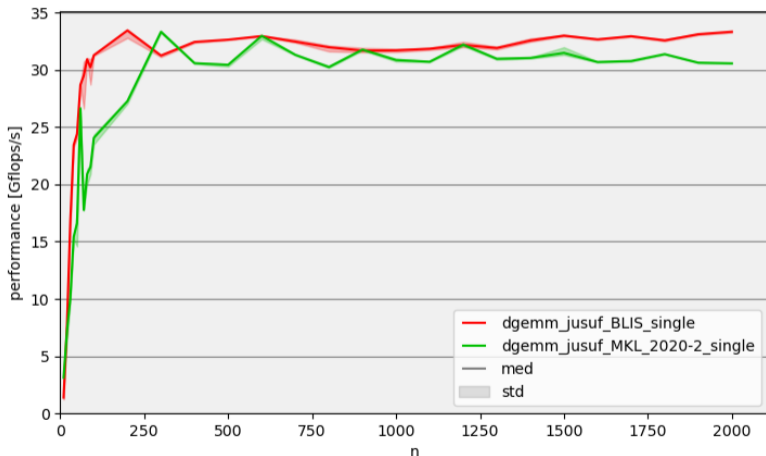
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Best math lib for AMD Rome?

- Performace is important!

- I like benchmarking!

- Performance model comparing alg A vs. alg B. To have an upper bond, I compute the Partical Peak Performance → extensive `DGEMM` benchmarking.

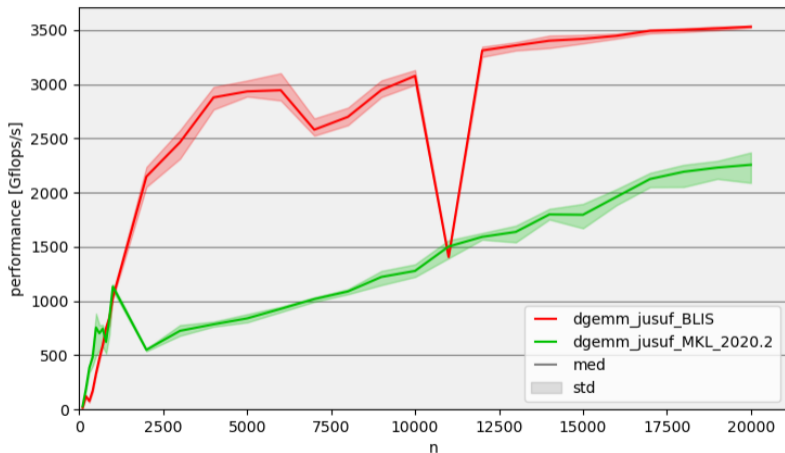JÜLICH
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ELAPS framework

dgemm: BLIS vs MKL (1 cores)

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dgemm: BLIS vs MKL (128 cores)

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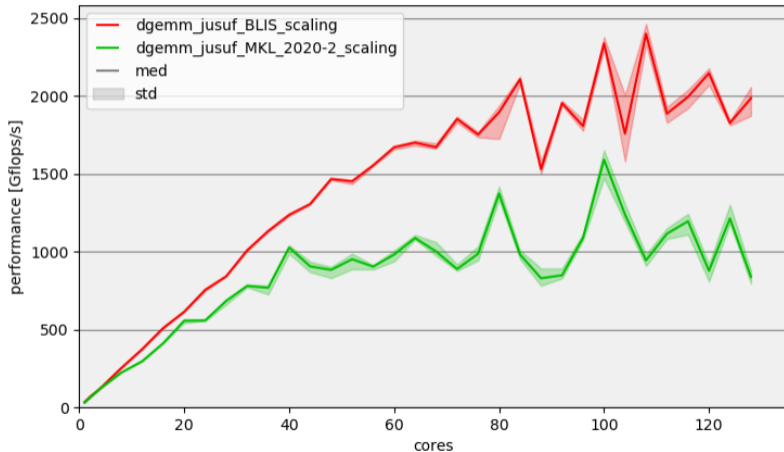
dgemm: BLIS vs MKL (n=m=k=8000)

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sgemm: BLIS vs MKL (1 cores)
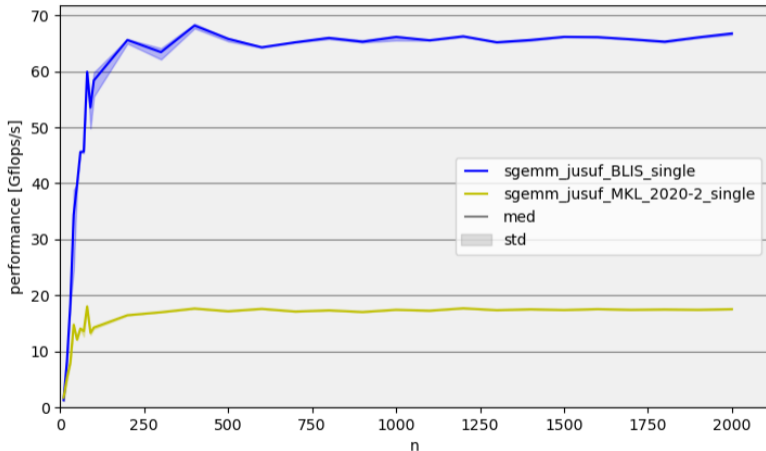
sgemm: BLIS vs MKL (128 cores)

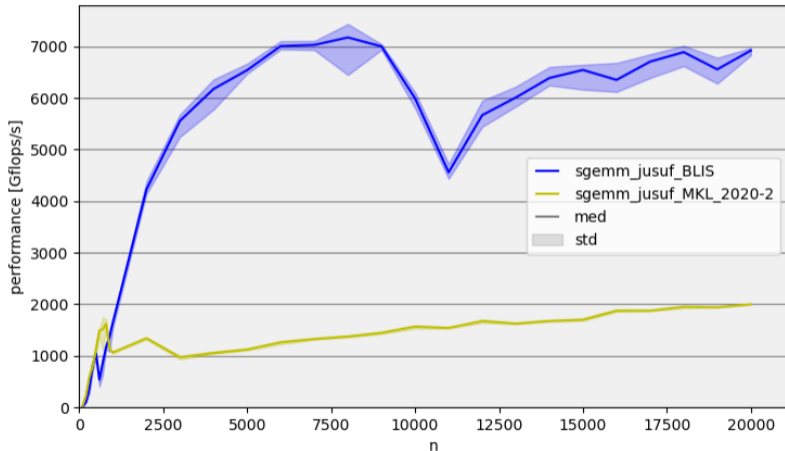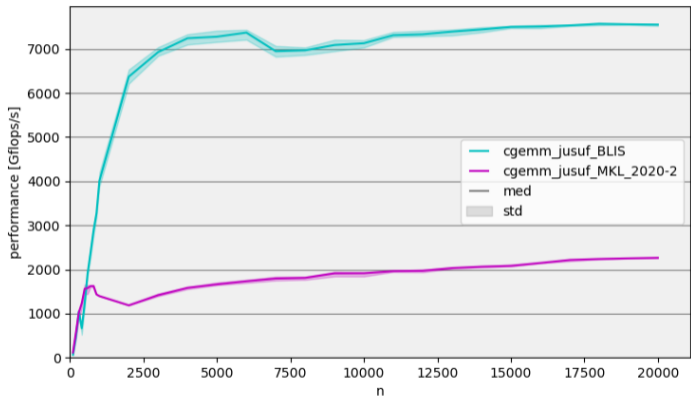# cgemm: BLIS vs MKL (128 cores)

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zgemm: BLIS vs MKL (128 cores)

BLIS: dual AMD Epyc 7742 (Zen2 "Rome") (128 cores)
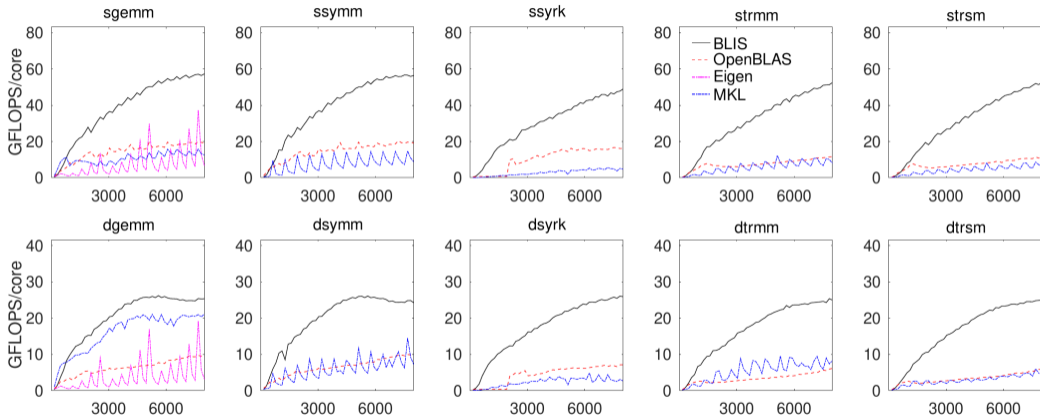
From the BLIS wiki.

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BLIS: dual AMD Epyc 7742 (Zen2 "Rome") (128 cores)

From the BLIS wiki.

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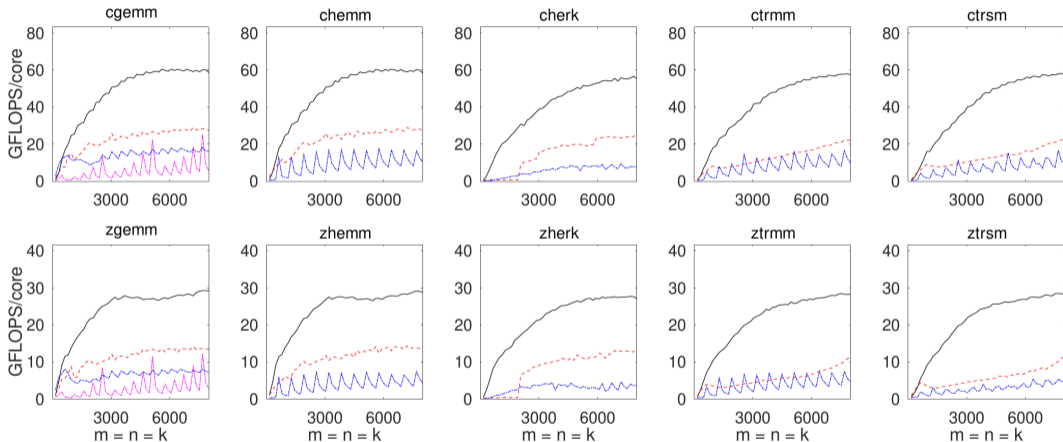
HPL: BLIS vs MKL

Performance on JUSUF @ JSC (theoretical PEAK: 4608 GFLOPS) with HPL using 1 node with 32 ranks and 4 cores each with 20% of memory (51.2GB out of 256G) used (Pinning with `OMP_PROC_BIND=TRUE` and `OMP_PLACES=cores`)

MKL/2020.2.254: T/V	N	NB	P	Q	Time	Gflops
WR01L2R4	82824	232	4	8	144.70	2.6176e+03

BLIS/2.2−amd: T/V	N	NB	P	Q	Time	Gflops
WR01L2R4	82824	232	4	8	130.08	2.9119e+03

HPL with BLIS is ∼ 10% faster.

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FFTW: FFTW 3.3.8 vs MKL

3D complex-to-complex (single threaded) Benchmark

	128x128x320	256x256x256	512x512x512
imkl/2020.2.254	41 ms	212 ms	1962 ms
FFTW/3.3.8	26 ms	136 ms	1303 ms
FFTW/3.3.8−amd	24 ms	103 ms	930 ms

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Idea for Toolchain: gobff

- GCC

- OpenMPI

- BLIS

- libFLAME

- FFTW

- ScaLAPACK

PR for gobff: PR 11761

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