LAPACK Performance Libraries

TASKING

AN ALTIUM BRAND

OVERVIEW

The TASKING® LAPACK Performance Libraries provide an implementation of the Linear Algebra PACKage (LAPACK) and Basic Linear Algebra Subroutines (BLAS) in the form of a highly optimized and tested ISO-C99 source code library.

For decades the LAPACK and BLAS mathematical libraries have been an integral part of Automotive MCAD/ECAD software. Nowadays these libraries are also used in embedded software, for example as part of the Advanced Driver Assist Systems (ADAS) that use state of the art mathematics which are best served from a set widely used, well tested, accurate, and fast de facto standard libraries.

The TASKING Performance Libraries for Tricore AURIX are highly optimized for the Infineon TriCore AURIX and AURIX 2nd Generation microcontrollers. This combination of hardware and software is well suited for use in safety critical systems, and offers an optimal choice to implement the automated driving functions that are specified in the Euro NCAP 2025 'In Pursuit of Vision Zero' roadmap.

PRODUCT BENEFITS

- Highly optimized numerical library
- Full LAPACK/BLAS single-precision support
- Compatible with MathWorks model-based design software
- Easily port existing mathematical software to embedded devices
- ISO26262 & ASIL-B compatible
- C source code available

The library provides a full implementation of the LAPACK and BLAS interfaces for single precision arithmetic and facilitates a seamless port of existing LAPACK/BLAS based software to embedded devices. The library is compatible with the MathWorks MATLAB and Simulink autocoders and other model-based design software, examples of such use case are provided with the software.

The Tricore AURIX port was done using ASPICE level-2 compliant processes, and the resulting code has been verified and validated using the de facto standard "LAPACK Test Suite". As such the library is suited for use in safety related systems up to ASIL-B.

IMPLEMENTATION FOR TRICORE AURIX

The TASKING library is based on the original http://www.netlib.org Fortran version 3.7.0. Since there are no high-quality Fortran compilers available for TriCore, the Fortran code has been translated to ISO-C99 using a Fortran-to-C translator whereafter the code has been hand optimized for use with the TASKING C compiler for TriCore to enable the compiler to emit code for the BLAS inner loops that is on par with handcrafted assembly. This ISO-C99 source code can be compiled with any C compiler for any (embedded) target, however in such case the performance may be suboptimal and the result is not pre-verified.

The implementation is single threaded and supports all single precision LAPACK/BLAS functions for real numbers.

The library is shipped in C source code together with object code, makefiles, and user documentation which incorporates an API reference derived from the Doxygen comments in the source files. The library can be (re)build with a TASKING VX-toolset for TriCore (not included) for AURIX and and AURIX 2G.

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PERFORMANCE METRICS

The peak single precision floating point performance of the AURIX hardware is 600 MFlop/s which is achieved by executing a sequence of multiply-accumulate instructions, counting as two Flops each, without loads and stores. BLAS functions load operands from RAM, store the computed result back to RAM, and do not use multiply-accumulate instructions only. This limits the theoretical peak performance of the hardware to 300 MFlop/s.

The graphs below show the performance of some commonly used functions where the library was built with TASKING VX-toolset for TriCore v6.2r2 and measurements were done on a TC298TE processor at 300MHz. Results for other functions or other parameter values can be obtained from TASKING upon request.

SGEMM & SGEMV Performance

Tricore TC29x at 300MHz
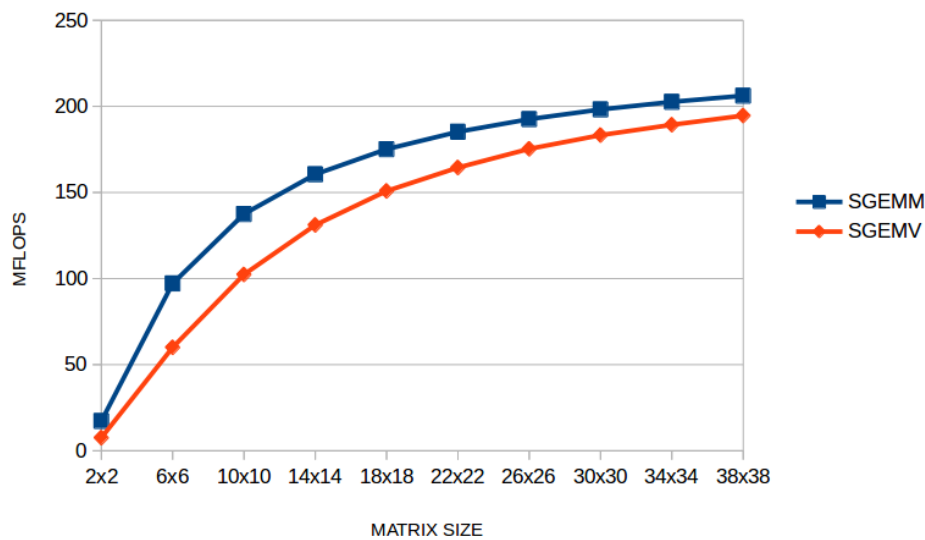
SDOT & SSYM Performance

Tricore TC29x at 300 MHz