

Updated Poster Abstract for PRACEdays22: “Performance Improvement of LIBRSB-1.3 Sparse BLAS on EuroHPC-class Systems”

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Abstract

Solving **large sparse systems** naturally arising from discretizing partial differential equations (PDEs) is the core of many simulations of various physical systems. In many cases this requires large-scale computation only possible to perform on massive parallel machines, like PRACE Tier 0 systems. In order to perform *efficiently* on novel HPC hardware (towards European Exascale systems), computing community software libraries have to be *adapted*.

Adapting software is also the motivation behind the “*forward looking software solutions*” project LYNCS of PRACE 6IP. LYNCS is a collaboration involving The Cyprus Institute¹ (Cyprus), the Leibniz Supercomputing Centre² (Germany) and Inria³ (France). The activity in project LYNCS resulted in the introduction of several aspects of *software sustainability* (language standards adherence, use of CI, performance portability) at the different levels of an entire software stack: from the *support library* level, via the *solver library*, up to the *application level*.

This poster is about the most general component of the said stack, namely LIBRSB⁴, a **complete shared-memory parallel “Sparse BLAS”** (Sparse Basic Linear Algebra Sub-routines) *support library*⁵

LIBRSB-related activity in LYNCS⁶ resulted in: **1)** a marked **performance improvement** of a key computational component in the application and solution of sparse linear systems (the SpMM kernel, namely multiplying a *sparse matrix* by a *tall dense* matrix), internally achieved through use of *templated modern C++*, and confirmed by a large performance experiment spanning various **EuroHPC**-class processors; **2)** improved **usability** across computer architectures, programming languages, OSs, and source distribution systems; **3)** enhanced **robustness** and quality thanks to the considerably enhanced test suite and usage of CI/CD.

While the *combination* of all three mentioned aspects is unique to LIBRSB, **focus of the poster** is restricted to **1)** and **2)**. The poster can be of interest to many, but mostly to prospective end-users, developers of *solver* packages, and HPC software curators.

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¹<https://www.cyi.ac.cy/>

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³<https://www.inria.fr>

⁴<http://librsb.sourceforge.net/>

⁵See Chapter 3 of the BLAS Technical Forum Standard (<http://www.netlib.org/blas/blast-forum/>) for definition and original API specification of its C/C++/FORTRAN *Sparse BLAS*, which **LIBRSB implements**.

⁶A full, detailed user-sided *changelogist* is available under <http://librsb.sourceforge.net/NEWS.TXT> .