LIBCEED – THE FINITE ELEMENTS LIBRARY WITHOUT ELEMENTS

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Abstract

LibCEED is a low-level, purely algebraic Finite Elements library developed within the Center for Efficient Exascale Discretizations (CEED), part of the Exascale Computing Project. LibCEED is an open-source, light-weight, **C99** library, with no dependencies, and **Fortran**, **Python**, **Julia**, and **Rust** interfaces. It offers a fully algebraic interface for efficient, scalable, and portable matrix-free implementations of high-order finite/spectral element operators that support a variety of computational device types (CPUs, GPUs, etc.), selectable at runtime.

libCEED backends

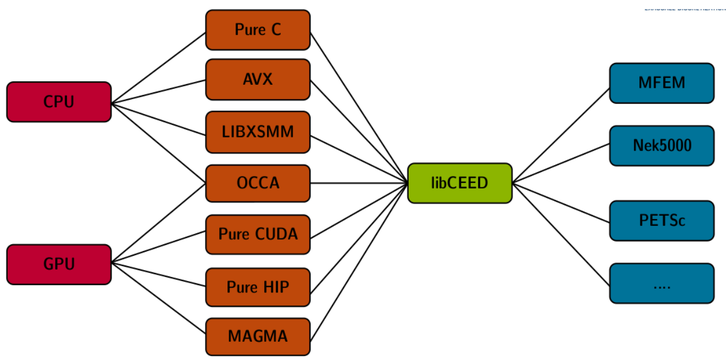
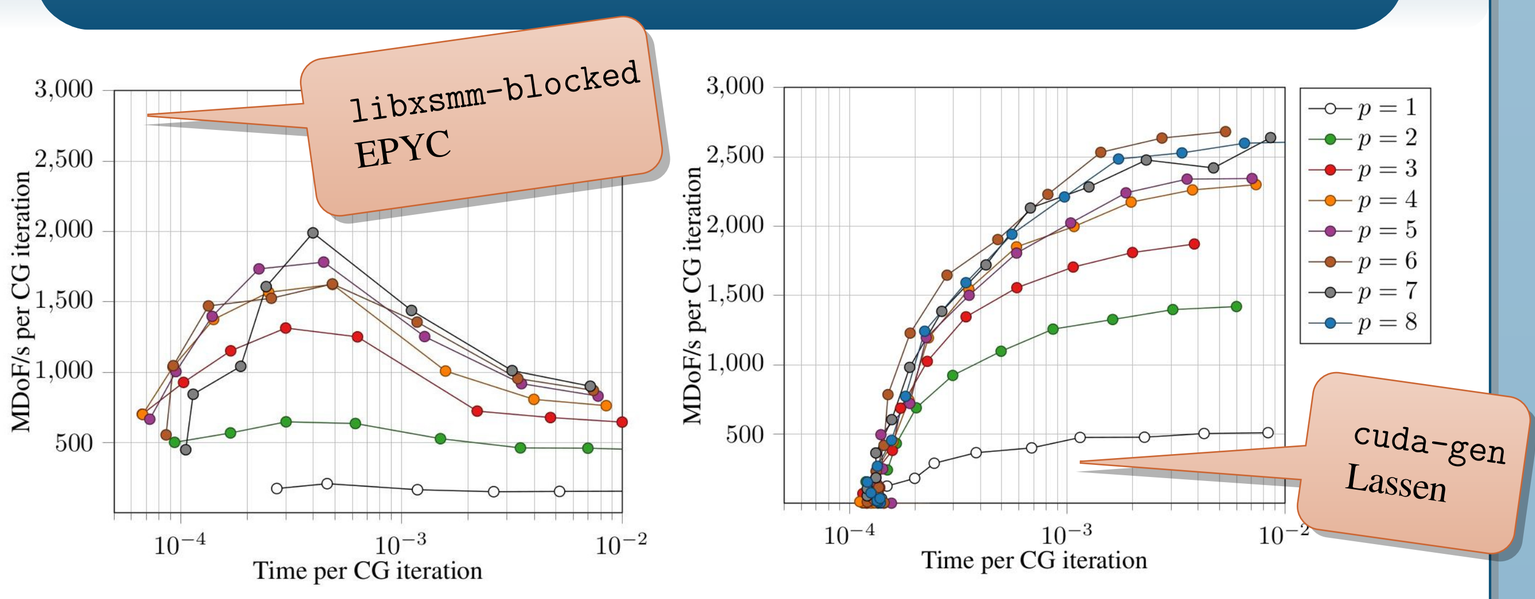


Fig. 1: libCEED's role as a low-level API for efficient, specialized implementations (backends)

Performance



Examples

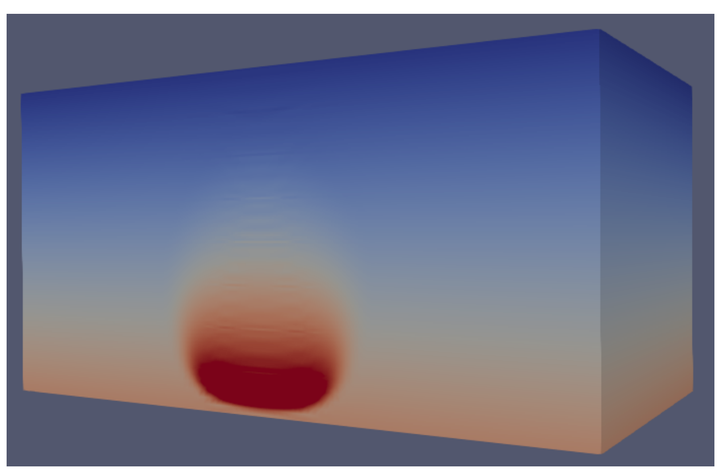
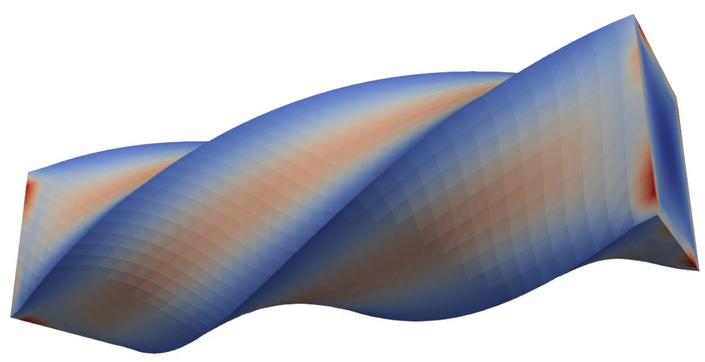


Fig. 2: A Navier-Stokes eqn.s solver–density current test case;

An Euler eqn.s solver–travelling vortex test case;



A Solid Mechanics example–twisted rod test case

References

- A. Abdelfattah, V. Barra, N. Beams, J. Brown, J-S. Camier, V. Dobrev, Y. Dudouit, L. Ghaffari, T. Kolev, D. Medina, T. Rathnayake, J. Thompson, S. Tomov, *libCEED User Manual* (Version 0.7) Zenodo. `http://doi.org/10.5281/zenodo.4302737`