Mathematics of the Weather 2024



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Jexpresso: an open source software package for the solution of general PDEs of computational mechanics.

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Jexpresso is a new multi-physics general solver designed to solve, by numerical means, arbitrary systems of PDEs while making it easy for a user to set up one's own specific physical problem. While the version V2.0 presented in this poster relies on spectral elements and finite differences, the code is structured so that a user can add other grid-based numerical methods of choice without altering the structure of the existing code. Jexpresso is parallel and runs on both CPUs and GPUs. It is built to solve systems of PDEs provided by the user through the definition of the vector of unknowns, the fluxes, sources and, when needed, a constitutive law (e.q. equation of state for ideal gases). If the equations are formulated in flux form, then nothing else is necessary from the user's perspective. Otherwise, if the equations are expressed in non-flux form (i.e. advective form), the user is also required to provide the matrix of non-constant coefficients. Independently of the equation set, initial and boundary conditions are also required. The user provides a simple boundary condition file that defines them as they are written on paper; nonetheless, the underlying code that handles them is hidden to the user.

Standard benchmarks and performance results are shown in the poster. The code is freely available via Github at https://github.com/smarras79/Jexpresso.

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