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Implementationof a modular software system for multiphysical processes in porous media

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Subsurface georeservoirs are a candidate technology for large scale energy storage required as part of the transition to renewable energy sources. The increased use of the subsurface results in competing interests and possible impacts on protected entities. To optimize and plan the use of the subsurface in large scale scenario analyses,powerful numerical frameworks are required that aid process understanding and can capture the coupled thermal (T), hydraulic (H), mechanical (M), and chemical (C) processes with high computational efficiency.

Due to having a multitude of different couplings between basic T, H, M, or C processes and the necessity to implement new numerical schemes the development focus has moved to software's modularity. The decreased coupling between the components results in two major advantages: easier addition of specialized processes and improvement of the code's testability and therefore its quality.

The idea of modularization is implemented on several levels, in addition to library based separation of the previous code version, by using generalized algorithms available in the Standard Template Library and the Boost library, relying on efficient implementations of liner algebra solvers, using concepts when designing new types, and localization of frequently accessed data structures. This procedure shows certain benefits for a flexible high-performance framework applied to the analysis of multipurpose georeservoirs.