Lower bounds, elliptic reconstruction and a posteriori error control of parabolic problems

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A popular approach for proving a posteriori error bounds in various norms for evolution problems with partial differential equations (PDEs) uses reconstruction operators to recover conforming objects from the approximate solutions. So far, lower bounds in reconstruction-based a posteriori error estimators have been proven only for time-discrete schemes for parabolic problems; the proof of lower bounds for fully discrete schemes in reconstruction-based a posteriori error estimators has eluded.

In this work, we provide a complete framework addressing this issue for energy-type norms. We consider Backward Euler discretisations and time-discontinuous Galerkin schemes, combined with dynamically changing conforming finite element methods in space, approximating linear parabolic problems. The results presented include sharp upper and lower a posteriori error bounds. Localised versions of the lower bounds are also considered.

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