APOSTERIORI ERROR ANALYSIS OF TIMESTEPPING SCHEMES FOR THE WAVE EQUATION

EMMANUIL GEORGOULIS, OMAR LAKKIS, CHARALAMBOS MAKRIDAKIS, AND JUHA VIRTANEN

Abstract. Aposteriori error estimates provide a rigorous foundation for the derivation of efficient adaptive algorithms for the approximation of solutions of partial differential equations. While the literature is rich as far as elliptic and parabolic equations are concerned, it is much less developed for the hyperbolic equations such as the wave equation. In this talk, I will review some of the "standard" aposteriori wave equation results, including those of [1] and [2], and present recent improvements and further developments to lower order Sobolev norms based on Baker's Trick [3] for backward Euler schemes. Subsequent focus will be given to practically relevant methods such as Verlet, or Cosine, methods, a popular example of which is the Leap-frog method [4].

References

[1] W. Bangerth and R. Rannacher. Adaptive finite element techniques for the acoustic wave equation. *J. Comput. Acoust.*, 9(2):575–591, 2001.

[2] C. Bernardi and E. Süli. Time and space adaptivity for the second-order wave equation. *Math. Models Methods Appl. Sci.*, 15(2):199–225, 2005.

[3] E. H. Georgoulis, O. Lakkis, and C. Makridakis. A posteriori $L^\infty(L^2)$-error bounds for finite element approximations to the wave equation. *IMA J. Numer. Anal.*, 33(4):1245–1264, 2013.

[4] E. H. Georgoulis, O. Lakkis, C. Makridakis, and J. M. Virtanen. A posteriori error estimates for leap-frog and cosine methods for second order evolution problems. Technical report, Nov. 2014. arXiv: 1411.7572. (accepted for publication on SIAM J. Numer. Anal. 2016)

University of Leicester, England UK & Technical University of Athens, Greece
E-mail address: eg64@leicester.ac.uk

University of Sussex, Brighton, England UK
E-mail address: o.lakkis@sussex.ac.uk

University of Sussex, Brighton, England UK
E-mail address: c.makridakis@sussex.ac.uk

(University of Leicester, United Kingdom
E-mail address: jv77@leicester.ac.uk