A STABILIZED HYBRID FINITE ELEMENT METHOD FOR PARABOLIC PROBLEMS

DAIANA S. BARREIRO, CRISTIANE O. FARIA, JOSÉ KARAM FILHO, ABIMAEL F. D. LOULA, AND SANDRA M. C. MALTA

Abstract. Recently, K. P. Fernandes et al. [1] analyzed the combination of a stabilized hybrid Galerkin method to the spatial variable, with an implicit finite difference scheme in the time integration, to solve parabolic problems. This fully discrete discontinuous approximation, was denoted by **FHTI**. The main reason of this study is due to the appearance of spurious oscillations, in the initial times when no regular data are considered and usual semi-discrete methodologies are applied to the approximation of the heat equation, as noted by I. Harari [2]. It was observed that the increasing of the **FHTI** stabilization parameter β_0 leads to the usual semi-discrete methodology, where the standard Galerkin (continuous) method is applied in the spatial variable and, therefore it is observed the appearance of these numerical inaccuracies mentioned before. On the other hand, decreasing the β_0 value is possible to find solutions free of the pollution caused by the error due to the spatial approach.

This paper aims to present a numerical analysis justifying the elimination of spurious oscillations when the discontinuous formulation **FHTI** is employed into parabolic problems approximations.

Keywords: finite elements, conforming approximations, discontinuous approximations, hybrid methods, parabolic problems **Mathematics Subject Classifications (2010)**: 65N30, 35K05, .

References

[1] K. P. Fernandes, S. M. C. Malta and A. F. D. Loula. Uma Formulação Hibridizada de Elementos Finitos para Problemas Parabólicos. *TEMA - Tendências em Matemática Aplicada e Computacional*, 14(3): 333-346,2013.

[2] I. Harari. Stability of semidiscrete formulations for parabolic problems at small time steps. *Comput. Methods Appl. Mech. Engrg.*, 193:1491-1516, 2004.

UERJ, RJ, Brazil
E-mail address: cofaria@ime.uerj.br

LNCC/MCTI, RJ, Brazil
E-mail address: daianasb@lncc.br, jkfi@lncc.br, aloc@lncc.br, smcm@lncc.br