STABILITY OF GALERKIN DISCRETIZATIONS OF PARABOLIC EVOLUTION EQUATIONS

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Abstract. We will study linear parabolic initial value problems of the form

$$\frac{\partial u}{\partial t}(t,x) + A(t)u(t,x) = g(t,x) \quad (0 < t < T, x \in \Omega),$$
$$u(0,x) = u_0(x) \quad (x \in \Omega)$$

for suitable functions g, u_0 and operators $A(t)$.

We will investigate a new mixed space-time variational formulation for this problem, and prove its well-posedness. We will show that for suitable pairs of finite element spaces, the resulting Galerkin operators are uniformly stable in that the inf-sup constant is bounded from below. We compare the method to two related space-time discretization methods introduced in [And13] and in [Ste15], and conclude that our method achieves the same accuracy at a lower computational cost.

References

[And13] R. Andreev. Stability of sparse space-time finite element discretizations of linear parabolic evolution equations. *IMA J. Numer. Anal.*, 33(1):242–260, 2013.

[Ste15] O. Steinbach. Space-Time Finite Element Methods for Parabolic Problems. *Comput. Methods Appl. Math.*, 15(4):551–566, 2015.

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