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"Formulação Semi-Discreta de Mínimos Quadrados Aplicada a Problemas de Difusão Pura e de Adevecção"

Diffusion and advection-diffusion equations have wide applicability in natural sciences and engineering. They may be used as model equations in environmental sciences, where tracking reactive pollutants is an important task, as well as meteorology and many other fields. In this work, semi-discrete finite element least-square formulation, applied to transient problems is presented. The original equations are rewriten as a first order equivalent system, thus reducing the extra regularity of the interpolation functions required in the classical approach of this formulation. The resulting matrices of the discrete problem are always symmetric and self adjoint, even when the original problem is non self adjoint. Moreover, even working with a mixed formulation, one has a minimization problem that does not require compatibility between the approximation spaces. Convergence rates for diffusion problems are presented and the influence of the irrotationality condition on the convergence rates are discussed for both cases. Two kind of time weighting are used for diffusion and advection problems and numerical results are presented, along with the discussion of the method's aplicability.