On the Locally Discontinuous Galerkin Method for problems with Signorini–type conditions

Rommel Bustinza

Dpto. de Ingeniería Matemática, Univ. de Concepción (Chile)

rbustinz@ing-mat.udec.cl

Francisco-Javier Sayas

Dpto. de Matemática Aplicada, CPS, Univ. de Zaragoza

jsayas@unizar.es

Resumen

In this talk we study the applicability of Discontinuous Galerkin methods to a class of variational inequalities arising from problems with Signorini–type (also called frictional) boundary conditions. In particular, we center our attention in the Locally Discontinuous Galerkin method of Cockburn and Shu, applied to a Poisson equation with boundary condition

$$u \geq 0, \qquad \partial_\nu u \geq g, \qquad u\,(\partial_\nu u - g) = 0$$

in part of the boundary and homogeneous Dirichlet condition on the remaining part. We derive a local description of the LDG method for this problem and write an equivalent reduced formulation, that is equivalent to a minimization problem in a space of discontinuous piecewise polynomial functions with a discrete version of the positivity condition on the boundary.

Based on this reduced formulation, we will discuss convergence and stability issues for the method. We will also deal with different possibilities for solving the inherent minimization problem, using the conjugate gradient method with projection or the associated Kuhn–Tucker system and an iterative method for it. Since the primal formulation is purely theoretical (the associated bilinear form cannot be assembled in a simple way), we will show how the iterations of the different methods require solving linear problems by an LDG method.

Sección en el CEDYA 2007: AN