

Dynamics with impact of elastic solids : issues, classical schemes and recent advances

Yves Renard

INSA Lyon, Université de Lyon, ICJ, LAMCOS, France.

The aim of the presentation is to propose an overview of the main difficulties encountered when constructing discretizations of dynamics with elastic solid impacts, particularly using spatial finite element discretization (difficulty to have energy conservation and avoiding spurious oscillations in particular).

One of the main specific difficulties in the construction of time integration schemes for the dynamics with impact of deformable solids, compared to other strongly non-linear problems, is that the finite element semi-discretization is a so-called measure differential inclusion which is notoriously ill-posed with very low regularity solutions. It is interesting to note that the ill-posed character of the finite element semi-discretization is not present in the case of the approximation of the contact condition by a penalty method [1]. The penalty method is however not consistent in the strong sense and induces an additional approximation. A second possibility is the use of Nitsche's methods which combines the fact of being strongly consistent and the well-posed character of semi-discretization (see [2]). In particular, in [3] a fully explicit schemes based on Verlet's scheme have been introduced, analyzed and compared to other previously introduced schemes for impact dynamics.

The presentation will focus on classical time discretizations of elastic structure impact problems and on some recent advances (Nitsche's method [3], CD-Lagrange FEM [4], space-time discretisation [5])

References

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