UEL Research & Knowledge Exchange Conference 2013

Call for Abstracts

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Title of Abstract:	Detailed Response Modelling of Nonlinear Soil-Structure Interaction.
Key Theme/ Key words:	Finite Element, Nonlinear Soil-Structure Interaction, Domain Decomposition, Iterative Coupling, Reduced Order Method.

Abstract (No more than 400 words):

This work is a multi-disciplinary research concerned with the generic computational modelling of coupled multi-physics structural and geotechnical systems, enabling the realistic modelling of nonlinear Soil-Structure Interaction (SSI).

Over the past few decades, detailed modelling methods for structural and problems have largely evolved separately, leading to advanced different discipline oriented tools with man-years of investment that work well for one of the physical sub-systems in SSI, but at best offering a crude approximation of the other sub-system(s). Accordingly, one of the main objectives of this research is the development of superior interactive coupling methods and novel advanced SSI simulation environment which could readily utilise heterogeneous discipline oriented computational tools, enabling the realistic, efficient and accurate modelling of sophisticated multi-physics SSI problems.

In this respect, the partitioned treatment, with soil and structural fields modelled as separate computational entities amongst which interaction effects are communicated, offers major benefits in the context of nonlinear soil-structure interaction. Such benefits include i) allowing field-specific discretisation and solution procedures that have proven performance for each partitioned soil/structure sub-domain, ii) facilitating the reuse of existing nonlinear analysis software with all the resource savings that this brings, and iii) enabling parallel computations through problem partitioning.

Novel formulations for coupling soil-structure systems, based on interface relaxation coupling methods, utilizing the tangent stiffness matrix of the partitioned sub-domains at the interface, and reduced order method approximations are proposed. The mathematical/computational characteristics and merits of the various existing and proposed algorithms, with particular reference to nonlinear-soil structure interaction problems are demonstrated.

Building on the above developed capability, in this work, the high potential and applicability of the proposed techniques is demonstrated through detailed nonlinear SSI modelling of building structures subjected to nearby excavations. It is worth mentioning that the above proposed coupling scheme is in general applicable for tackling a myriad of cutting edge SSI problems.