A PARALLELIZED DISCRETE ELEMENT METHOD FOR ANALYSIS OF DRILL-BIT MECHANICS PROBLEMS IN HARD AND SOFT SOILS

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We present recent developments in the development of a parallel Discrete Element Method (DEM) for analysis of drill-bit mechanics problems typical in the oil and gas industry. A new local DEM constitutive model able to predict the non-linear behavior of soft and hard soils and rock in dry and saturated conditions under drilling loads inducing multi-fracture of the material is presented.

The solution of the DEM equations has been implemented to work in parallel computers compatible with both OpenMP and MPI architectures. The parallel computing implementation has been carried out within the Kratos multiphysics environment developed at CIMNE [1]. The computational efficiency, accuracy and scalability of the resulting parallel DEM code has been validated in the study of triaxial tests for concrete and cement materials for which experimental results are available using different DEM discretizations.

The paper describes the basis of the DEM formulation and its implementation in a parallel code. A number of applications of the parallel code to practical drill-bit mechanics problems of interest to the drilling industry are presented.

REFERENCES

1. Kratos. A framework for developing parallel finite element and particle-based codes for multiphysics problems. www.cimne.com/kratos, CIMNE, Barcelona ,2013.