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Poly3D boundary element code with inequality constraints: More potential to model natural structures

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Some of the major challenges using boundary element codes are: (i) limiting the amount of memory necessary to solve large and dense systems; and (ii) incorporating traction inequality constraints (TIC) and displacement inequality constraints (DIC). The latter serves two purposes: first to simulate friction using the Coulomb criteria (TIC) for instance; and second to bound the displacement discontinuity onto the modeled fractures (using DIC).

Since Poly3D is now widely used around the world as a research tool for studying fracture mechanics, rock deformations, earthquakes and volcanoes, we have developed a method that addresses these two purposes at the same time. We show that the use of a discrete iterative solver not only permits to compute very large model by avoiding allocation of significant memory while solving the system, but also authorizes new unexpected features to be implemented such as TIC and DIC.

To illustrate these new potential, we give an example of one particular TIC, the static Coulomb friction, for the modeling of cohesive end zones (CEZ) to explain the low value of the kink angles observed in the faults in the Waterpocket monocline (Utah, USA). We also give an application of one DIC for characterizing secondary features such as stylotites around curving and overlapping fractures, in Jurassic limestone from Montpellier area, Southern France.