A Boundary Element Method for an elastoplastic contact problem

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We consider an elastoplastic two body contact problem with friction under small strain, plain strain theories in 2D. An interaction of bodies is described by the penetration theory, J_2 flow theory with isotropic/kinematic hardening for plasticity is used. The Galerkin Boundary element method with Newton potentials is used to obtain a weak formulation of the elastoplastic contact problem. Newton potentials occur due to plastic deformations that introduce additional terms in the representation formula for displacement and stresses. Those terms are nothing more than integration of plastic part of strain tensor over domain with specific singular kernels. We obtain a discrete nonlinear system under plastic and contact constrains. These system is solved with the Newton method. The Advantage of the BE approach with respect to FE is a smaller number of unknowns that one has to manage to obtain the discrete approximation of the solution. Using boundary elements one has to overcome difficulties dealing with the boundary integrals with singular and hyper singular kernels. For polynomial functions such integrals can be easily regularized by integration by parts. Therefore recursion formulas can be used for numerical realization. All implementation was done with the scientific package maiprogs using Fortran F95. Simulation showed good agreement FEM with BEM solutions.

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