This thesis introduces a parametric study of the Particle Finite Element Method applied to the modeling of friction, wear and excavation processes. These phenomena demand fast geometry changes where a special formulation in solid mechanics and the continuum is compulsory. Friction and wear general laws are presented in order to apply them at macroscopic level due to excavation modeling. Different examples are studied to calibrate friction and wear, analyzing the normal and tangential force evolution produced in 2D and 3D models. Excavation processes are tested in order to compute the contact forces. Finally, general conclusions are established based on the force distribution and theoretical-analytical results obtained.