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Hydromechanical coupling in hydrofracture, sedimentation and friction weakened by fluid flow: application of hybrid granular / continuous fluid flow modeling.

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In numerous mechanical applications, porous solids can be deformed beyond the elastic limit, and feel the mechanical influence of the seepage of their intersticial fluid. This is the case, notably, in the following situations: 1. a fluid is injected at high rate or high pressure gradient in a lowly porous rock; 2. when fluid rises through a porous rock due to buoyancy forces, or when a granular material of sufficiently fine material sediments through a confined fluid, or 3. when a fluid-filled gouge is sheared during the nucleation of a seismic source, or of a slippage plane in an avalanche, lubricating the otherwise solid system and possibly leading to hydroplanning or liquefaction. Such situations can be modeled numerically, describing the solid as an assembly of grains with short range interactions, and the fluid flowing through it by continuous partial differential equations, obtained by the integration of first principles (conservation of mass and conservation of momentum). Each of the situations described above lead to characteristic dynamic regimes depending on the fluid pressure gradient, and to characteristic pattern formation and flow channelization. We will briefly classify and characterize geometrically these patterns depending on the control parameters, mainly imposed pressure gradients, boundary conditions and grain dimensions in these situa-

tions. The code results will be compared to model experiments in laboratories.