Geological faults: Lagrangian formulation of contact mechanic problem

- The stress variations induced by gas/oil production or injection may activate pre-existing regional faults located in the reservoir surrounding.
- Numerical simulation of discontinuities can not be performed by classic finite element (due to compatibility condition).
- Numerical solution: discretization of fault by interface finite elements and Lagrange method to enforce contact condition.

Fault activation by water extraction Mexico City (Mexico)
Seismic section showing a reservoir crossed by faults and thrusts.
Interface element (IE) for fault analysis
A reservoir with two faults is analysed. Pressure decreased by 100 bar in 10 years. Results on possible fault activation is showed after 8 years of production.

Realistic application of fault modelling

3D mesh, with reservoir highlighted in red

Fault discretization by IE

Fault slipping

Normal stress on the fault plane

Tangential stress on the fault plane