

# Petroleum Geomechanics

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**“The legacy of Ioannis Vardoulakis to Geomechanics”**

Coordination: **Jean Sulem** and **Cino Viggiani**

## Ioannis Vardoulakis (1949-2009)



# Petroleum Geomechanics in 2020

- **Well Construction**
  - stable trajectory, mud-density prediction
  - hole-cleaning
  - bit selection
  - pore-pressure prediction
  - cuttings re-injection
  - Real Time Wellbore Stability (RTWS)
- **Hydraulic Fracturing**
  - modeling
  - characterization
- **Sand Production and Control**
  - sand prediction
  - gravel-packing, frac & pack, oriented perforations, formation consolidation
  - productivity
- **Reservoir Geomechanics**
  - surface subsidence
  - compaction drives production
  - stress-dependent permeability
  - fault activation, casing collapse, small earthquakes
  - direction of water-flooding
  - optimum well placement
  - 4-D seismic interpretation

# Drivers for advances

- Offshore deep-water drilling, rig daily-rates
  - deep water in GM, EastMed \$ 500,000/day
- Drilling in harsh environment
  - tectonic fields, salt-domes, deep water
  - horizontal, extended reach, multilateral junctions
- Environmental concern
  - cuttings, water re-injections
  - subsidence
- Higher recovery
  - reservoir depletions
- Fracking
- Technology advances
  - internet, visualization tools, cloud-computing, big data, etc

# Outstanding technical issues

- Formation-pressure evaluation
- Quantities of produced-sand
- Hydraulic fracture characterization
- Determination of maximum and intermediate in-situ stresses
- Continuous rock-strength determination
- Rock deformation-failure prediction
- Calibration of models