PETE 7241 - Geomechanics with applications in Petroleum Engineering Problems

Instructor: Dr. Arash Dahi   Spring 2010
Office: Room 3425, Patrick Taylor Hall
Email: a_dahi@lsu.edu
Office Hours: TH 4:00-6:00, T 4:00-5:00
Class:
Midterm exam:

Course Description

The first part of the course deals with the fundamentals of rock mechanics. This includes theories of elasticity and failure mechanics, borehole stresses, and acoustic wave propagation. Fundamentals of the theory of poroelasticity will be explained. After that we will talk about methods for obtaining parameters that are relevant for rock mechanics field application, ranging from laboratory tests to borehole logs. In the last part of the course, we will discuss applications of rock mechanics in borehole stability, sand production, hydraulic fracturing and reservoir compaction/ reservoir subsidence.

Course References

[J] Jaeger and Cook, Fundamentals of rock mechanics, Wiley-Blackwell; 4 edition. (Required textbook)

[F] Petroleum Related Rock Mechanics by Erling Fjaer, Rune M. Holt, Per Horsrud, and Arne M. Raaen (Hardcover - Jan 1, 1992)

[Z] Reservoir Geomechanics, Mark Zoback, Cambridge University Press, 1st edition.

[W] Theory of Linear Poroelasticity with applications to Geomechanics and hydrogeology, Herbert F. Wang, Princeton University Press.

[BCZ] Bourbie, Coussy and Zinszner, Acoustics of porous media.

Outlines

Elasticity
      Strain
      Stress
      Constitutive Equations
      Elastic moduli

Poroelasticity
      Biot's poroelastic theory for static properties
      The effective stress concepts

Failure Mechanics
      Basic concepts
      Compressive strength criteria
      Shear failure – Mohr-Coulomb criterion
      Failure criteria which depends on the intermediate stress

Some geological aspects of rock mechanics
      In-situ stresses
      Rock mechanical properties

Stresses around borehole, and borehole failure criteria
      Stresses around a borehole – general linear elastic solution
      Stresses around a borehole in a poroelastic formation
      Borehole failure criteria

Reservoir Compaction: Subsidence and well problems
      Elastic Modelling
            Compaction of the reservoir
            Stress changes in depleting reservoirs
      Consolidation Theory

***(Optional)* Sand Prediction**
      What is sand production?
      Mechanisms for sand production
      Modelling for sand production

***(Optional)* Acoustic wave propagation in rocks**
      The wave equation
      P- and S- waves
      Sound velocities in rock

Disability Services
If you have a disability that may have some impact on your work in this class and for which you may require accommodations, please see an advisor in the office of Disability

Services (112 Johnston Hall) so that necessary accommodations may be arranged. After you receive accommodation letters, please see the instructor as soon as possible to discuss the provisions of those accommodations.

Misconduct/Dishonesty
Any kind of misconduct and dishonesty will be reported to the department chair, the Dean of Engineering, and/or the Dean of students in writing. Then the case will be investigated by the university (Not by the instructor) and the students have the right to appeal to the university.