ROCK MECHANICS
AND
ACOUSTIC EMISSION/
MICROSEISMIC MONITORING

Maochen Ge
TEACHING

• Mi Eng 331 Rock Mechanics (I)
• Mi Eng 332 Soils and Overburden Materials
• Mi Eng 432 Rock Mechanics (II)
• Mi Eng 235 Underground Mine design
• Mi Eng Geostatistics
331 ROCK MECHANICS (I)
(232 Statistics and Mechanics of Rock Materials)

1. Review of fundamental mechanics principles
2. In situ stresses
3. Basic rock mechanics instrumentation
4. Rock properties
5. Field instrumentation
6. Pillar design
7. Roof span design
8. Rock reinforcement
9. Surface subsidence
10. Rock burst
11. Slope stability
TEACHING

• Mi Eng 331 Rock Mechanics (I)
• Mi Eng 332 Soils and Overburden Materials
• Mi Eng 432 Rock Mechanics (II)
• Mi Eng 235 Underground Mine design
• Mi Eng Geostatistics
1. Soil classification
2. Effective stress and pore pressure
3. The movement of water through soil
4. Shear strength and failure criteria
5. Compaction, settlement in soils
6. One dimensional consolidation
7. Bearing capacity of shallow foundations
8. Stability of earth slopes
9. Retaining walls
10. Waste impoundments
11. Surface mine reclamation (backfilling, grading of spoil, etc)
TEACHING

• Mi Eng 331 Rock Mechanics (I)
• Mi Eng 332 Soils and Overburden Materials
• Mi Eng 432 Rock Mechanics (II)
• Mi Eng 235 Underground Mine design
• Mi Eng Geostatistics
432 Rock Mechanics II

1. **Rock slope engineering** (basic mechanics of slope failure, stereonet graphical method, Shear strength of rock, groundwater flow, plane failure, wedge failure, circular failure)

2. **Rockmass classification and empirical methods of design** (Terzaghi’s rock load classification, Geomechanics classification, Q-system)

3. **Rock support principles and methods** (Mechanics of rock-support interaction, mechanics of rock bolts, design guidelines for rock bolt systems)

4. **Rock dynamics** (waves and vibration, blasting monitoring, rockburst and seismicity, geophysical methods for ground control)
Rock Mechanics Laboratory

1. **Rock specimen preparation room and equipments** (core drill, diamond cut-off saw, surface grinder) need to be repaired and updated.

2. **Two test machines, TerraTek and Tinius-Olsen** in B28 need to be calibrated and documented.

3. **New instruments for strain gage installation and measurement** (Strain Gage Bridge, Strain Gage Switching and Balancing Unit, Instrumented Cantilever Beam) need to be purchased.

4. **New devices for indirect compressive strength testing** (point load tester and National Coal Board Cone Indenter) need to be purchased.

5. **Underground measurement devices** (tape extensometer, etc) need to be purchased.

6. Instruments for demonstration purposes (load cells, LVDT, vibrating gage, etc) need to be purchased.

7. Rock bolts and cables for demonstration
Research

1. **Rockburst and microseismic monitoring**
   (Homestake, Creighton, Campbell Red Lake, Kidd Creek, North Mine, Sigma, Chimo, Copper Rand, Springfield Pike Mine)

2. **Void detection**

3. **Geotomography**

4. **None destructive testing**
By 9:15 AM, Water begins to flow out of Portals, Water Level at 1836’, 1st Left Potentially Under Water

Diesel Pumps Installed

Preliminary and Conjectural Information Only
By 4:07 PM on Thursday, Water Stabilized in Pit at about 1852’, 3 Diesel Pumps Operating (~15,000 GPM)

Preliminary and Conjectural Information Only
The 6” Borehole is Drilled into the Mine
The Broken Drill Bit is Removed from the Borehole. Reaming with a Slightly Larger Bit Begins at 8:40 PM on Friday
Collar installed for 30” Rescue Borehole
Briefings by MSHA, State, and Company Officials were Conducted Regularly with the Families, and of Course, with the Media.
ISS BASED VOID DETECTION TECHNIQUE
A close-up view of Love waves
Applications in trona mines
- Monitoring barrier pillars
PAST RESEARCH

1. **Rockburst and microseismic monitoring**
   (Homestake, Creighton, Campbell Red Lake, Kidd Creek, North Mine, Sigma, Chimo, Copper Rand, Springfield Pike Mine)

2. ** Void detection**

3. **Geotomography**

4. **None destructive testing**
PANNED RESEARCH

1. Catastrophic failure in mines,
2. mapping of fracturing process for natural gas recovering,
3. safe CO2 sequestration, and
4. structure integrity and aging infrastructures.