

ROCK MECHANICS AND FRACTURE HYDROLOGY SEMINAR (EGEE 596) Sp 2004

Credits: 1

Instructors: Derek Elsworth & Phillip Halleck

Content: Continuum mechanics, states of stress, strength of geologic materials, mechanical behavior of fractures in rock, multiphase flow and reactive chemistry.

Objective: Develop an appreciation of the basic concepts of continuum mechanics and reactive chemistry applied to flow, transport and reaction in rock fractures.

Meeting: TBA

1. Introduction

2. Stress and Infinitesimal Strain

Brady, B.H.G. and Brown, E.T. (1983) Rock Mechanics for Underground Mining. George, Allen & Unwin. 527p.

Chapters 1+2

Also:

Intro: www.ems.psu.edu/~elsworth/courses/geoe500/GeoEE500_4.pdf

Coupled Flow: www.ems.psu.edu/~elsworth/courses/geoe500/GeoEE500_1.PDF

3. Rock Mass Structure

Brady & Brown (1983) **Chapter 3**

4. States of Stress near engineering structures

Notes and Spreadsheet

5. Rock Strength and Deformation

Brady & Brown (1983) **Chapter 4**

6. Behavior of Discontinuities

- i. Mechanical and Hydraulic
 - Gangi (1978)*
 - Brown and Scholz (1986)*
 - Tsang and Witherspoon (1981 & 1983)*
 - Cook (1992)*
 - Zimmerman and Bodvarsson (1996)*
- ii. Chemical
 - Yeh ()
 - Bethke ()
 - Steeffel and MacQuarrie ()

Grading: 100% oral contact.

References

Brady, B.H.G. and Brown, E.T. (1983) Rock Mechanics for Underground Mining. George, Allen & Unwin. 527p.

Brown, S.R., and Scholz, C.H., 1986, Closure of Rock Joints: *Journal of Geophysical Research-Solid Earth and Planets*, v. 91, p. 4939-4948.

Cook, N.G.W., 1992, Natural Joints in Rock - Mechanical, Hydraulic and Seismic Behavior and Properties under Normal Stress: *International Journal of Rock Mechanics and Mining Sciences & Geomechanics Abstracts*, v. 29, p. 198-223.

Gangi, A F, 1978. Variation of whole and fractured porous rock permeability with confining pressure. *International Journal of Rock Mechanics and Mining Sciences & Geomechanics Abstracts*, vol.15, no.5, pp.249-257, Oct 1978

Tsang, Y W; Witherspoon, Paul A., 1983. The dependence of fracture mechanical and fluid flow properties on fracture roughness and sample size. *Journal of Geophysical Research. B*, vol.88, no.3, pp.2359-2366.

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A Partial Bibliography of Flow and Transport in Deforming Rock Fractures

Bai, M. and Elsworth, D. (1994) Permeability changes during subsidence over a mined panel. *R. Mech. and R. Eng.*

Bai, M. and Elsworth, D. (1999) Deformation, Flow and Transport in Porous and Fractured Media. ASCE Press, in press, 400 pp.

Bandis, S. C., A. C. Lumsden and N. R. Barton (1983) Experimental Studies of scale effects on the shear behavior of rock joints. *Int. J. R. Mech.*, 20, 249 - 268.

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Békri, S., J. F. Thouvert, and P. M. Adler (1995) Dissolution of porous media, *Chem. Eng. Sci.*, 50 (15), 2765-2791.

Békri, S., J. F. Thouvert, and P. M. Adler (1997) Dissolution and precipitation in fractures, *Eng. Geol.*, 50 48, 283 - 308.

Berkowitz, B. and J. Zhou (1996) Reactive transport in a single fracture, *Water Resour. Res.*, 32 (4), 901-913.

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