FysGeo 4300 - Methods in Physics of Geological Processes

Autumn 2005

This course will introduce the students to advanced methods used to study geological processes. These methods may be divided into field observation, analysis of rock samples, mathematical modelling, numerical simulation and experiments. The students will learn the principal idea of the different methods and they will apply them to phenomena related to diffusion and elasticity.

Hours	Theme	Teacher
General		
1	Introduction	Dag
3	Discrete simulations	Dag and Anders
3	Continuum simulations	Yuri
3	Analogue experiments, scaling, control and measurement	Dag
2	Geological maps	Torgeir
2	Graphical presentation of structure data	Torgeir
2	Introduction to Matlab	??
Diffusion		
Theory		
1	Geological importance of mass and heat diffusion	Bjørn
2	The diffusion equation, boundary conditions and solutions	Dag
Practical		
2	Analytical exercise	Dag
4	Microscopy, SEM, EMP on garnet zoning and limestone/clay transition, comparison with analytical solution, fitting to data.	Håkon, Dag
4	Numerical solutions of the diffusion equation	Yuri
4	Discrete simulations of diffusion problems	Anders
4	Experiments on heat conduction and Ostwald ripening	Dag
Elasticity		
Theory		
1	Fractures on different scales in nature	Bjørn
2	Elasticity and Mohr circle analysis	Dani
4	Continuum simulation of wave propagation	Yuri
Practical		
6	Field mapping of fracture system in Oslo area	Torgeir
4	Continuum simulation of wave propagation	Yuri
4	Experiments using stress birefringence	Dag

Tuesdays:

Theory, analytical excersise:	10:15-12:00	Room 414A
Practical:	08:15-14:00	Different locations

Fridays:

Theory, analytical excersise:	12:15-14:00	Room 437B

Week 34			
23.08.	Theory	1h intro	Dag
26.08.	Theory	2h diffusion equation	Dag
Week 35			
30.08.	Theory	2h discrete simulations	Anders
02.09.	Theory	2h introduction to Matlab	??
Week 36			
09.09.	Practical	4h (10-14) diffusion discrete simulations	Anders
Week 37			
(12.-14.09	Field work 4200)		
16.09.	Theory/Ex	10-12 Geol. Maps, 12-14 anal exercise, diffusion	Torgeir/Dag
Week 38			
20.09.	Theory	2h graphical presentation, stereomaps	Torgeir
23.09.	Practical	6h fracture field work (all day)	Torgeir
	Report in	diffusion discrete simulations	
Week 39			
27.09.	Theory	2h elasticity and Mohr circle analysis	Dani
30.09.	Theory	1h geological impact of diffusion, 1h MD	Bjørn, Dag
Week 40			
04.10.	Practical	4h diffusion experiments, group 1	Dag
07.10.	Practical	4h diffusion experiments, group 2	Dag
	Report in	fracture field work	
Week 41			
11.10.	Theory	1h fractures in nature	Bjørn
14.10.	Theory	2h continuum simulations	Yuri
Week 42			
18.10.	Practical	2h diffusion continuum simulations	Yuri
21.10.	Practical	2h diffusion continuum simulations	Yuri
	Report in	diffusion experiments	
Week 43			
25.10.	Theory	2h analogue experiments	Dag
28.10.	Theory	1h image analysis	Dag
Week 44			
01.11.	Practical	4h diffusion rock analysis, group 1	Håkon
04.11.	Practical	4h diffusion rock analysis, group 2	Håkon
	Report in	diffusion continuum simulations	
Week 45			
08.11.	Theory	2h wave propagation simulations	Yuri
11.11.	Theory	2h wave propagation simulations	Yuri
Week 46			
15.11.	Practical	2h wave propagation simulations	Yuri
18.11.	Practical	2h wave propagation simulations	Yuri
	Report in	diffusion rock analysis	
Week 47			
22.11.	Practical	4h stress birefringence experiments, group 1	Dag
25.11.	Practical	4h stress birefringence experiments, group 2	Dag
	Report in	wave propagation simulations	
Week 48			
02.12.	Report in	stress birefringence experiments	
Week 49			
09.12.	Oral examination		

Rephrasing of the content:

Discrete:

Molecular Dynamics, Lennard-Jones potential, solids-liquids
Random walk -> diffusion, scaling analysis, box counting

Continuum: Finite differences

Diffusion 1D and 2D
Elasticity and wave propagation 1D and 2D

Experimental:

Diffusion, heat conduction, IR imaging, chemical potential gradient, Ostwald ripening
Stress birefringence, deformation, image analysis

Field:

Diffusion/reaction of garnet, microsonde
Maps, stereograms, Mohr circle analysis

Background:

Diffusion, elasticity, Matlab