

# Reactive Transport in Porous Media

## GEO 391, Spring 2015

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### Class details

Class room: JGB 3.120  
Class time: Tu/Th 11:00-12:30  
Unique: 27180  
Prerequisites: CHE 381P or PGE 381K (vector calculus, differential equations)  
GEO 325J or GEO 371C (Matlab)  
Description: Reactive flow is a pervasive phenomenon in Geosciences that creates patterns at all length scales, which contain information about geologic processes. This course provides foundation for the subject based on the theory of hyperbolic conservation laws. The focus will be on surface reactions with multiple interacting species that control contaminant migration. The course will discuss the chemical models, the theoretical analysis of transport phenomena and numerical implementation in MATLAB.

### Instructor

Instructor: Dr. Marc Hesse  
Office: EPS 3.120  
Office hours: TBD  
Email: [mhesse@jsg.utexas.edu](mailto:mhesse@jsg.utexas.edu)  
html: <http://www.jsg.utexas.edu/hesse>

### Assessment

Grading: The class will be graded based on weekly homeworks.  
Collaboration: Homeworks can/should be discussed amongst students, but the solutions have to be written up individually.

### Course materials

No textbook is required

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# Syllabus

week	dates	lecture	topics	homework
1	20, 23 Jan	0	Overview, Conservation laws	
2	27, 29 Jan	1, 2	Discrete operators, Dirichlet BCs	HW 1
3	3, 5 Feb	3, 4	Neumann BCs, heterogeneity	HW 2
4	10, 12 Feb	5, 6	Solute mass balance, method of characteristics	HW 3
5	17, 19 Feb	7, 8	Numerical methods for advection	HW 4
6	24, 26 Feb	9, 10	Single component adsorption	HW 6
7	3, 5 Mar	11, 12	Shock & Rarefaction waves,	HW 7
8	10, 12 Mar	13, 14	Newtons method, Wave interactions	HW 8
9	17, 19 Mar		spring break	-
	24-26 Mar	15, 16	Hyperbolic systems	
10	31 Mar, 2 Apr	17, 18	Integral curves and Hugoniot loci	TBD
11	7, 9 Apr	19, 20	Theory of chromatography	...
12	14,16 Apr	21, 22	Ternary ion-exchange	...
13	21, 23 Apr	23, 24	buffer	...
14	28, 30 Apr	25, 26	buffer	...
14	5, 7 May	27, 28	buffer	...

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