General Course Information

instructor:	Professor Dennis Kochmann 374 Firestone (formerly 302), ext. 8113 kochmann@caltech.edu office hours: anytime (preferably in the afternoon)
TAs:	Vidyasagar, 308 Guggenheim, vvidyasa@caltech.edu Greg Phlipot, 315 Firestone, gphlipot@caltech.edu Carlos Portela, cportela@caltech.edu
class website:	`kochmann.caltech.edu/teaching.html`
class:	Tuesdays & Thursdays, 2:30 – 3:55 pm, 101 Guggenheim
office hours:	Wednesdays, 6 pm, 328 SFL
codes:	We will use the computational code developed in Ae214a.
textbook:	There is no required textbook, the following books are useful references: *Continuum Mechanics:* · Tadmor, E.B., Miller, R.E., Elliot, R.E., Continuum Mechanics and Thermodynamics. · Continuum Mechanics notes by Prof. Ortiz are available online. *Finite Element Analysis:* · Cook, R. D., et al., Concepts and applications of finite element analysis. · Reddy, J. N., An introduction to the finite element method. · FEA course notes by Prof. Papadopoulos are available online. · The Ae214a course notes are available online.
homework:	is posted online Fridays by 3 pm; completed homework should be turned in into the mail holders in front of 374 Firestone in due time.
homework policy:	You are strongly encouraged to discuss homework problems and solution strategies with each other. The first problem set is individual, each student submits a solution. The second problem set can be solved in teams of up to four students, jointly handing in their team solution. The honor code applies.
late homework:	Late homework (within 24 hours) incurs a 50% penalty. In case of conference travel, field work, or illness, please arrange with the instructor for an extension in advance.
project:	During the second half of the term we will work on team research projects. Every team will present their project outcomes in class and submit a report.
grading:	The final grade is composed of 50% homework and 50% project (presentation, code and report). There will be no midterm or final exams.

Tentative Syllabus

date	topics
01/05/17	review of computational mechanics, multiscale modeling
	01/06/17: hw set 1 posted
01/10/17	multiscale modeling, homogenization problem
01/12/17	micro-to-macro transition, averaging theorems
01/17/17	averaging theorems, applications
01/19/17	computational homogenization
	01/20/17: hw set 1 due, hw set 2 posted
01/24/17	computational homogenization: boundary conditions
01/26/17	computational homogenization: periodic BCs
01/31/17	computational homogenization: implementation
02/02/17	computational homogenization: FE^2
02/07/17	spectral methods
02/08/17	*make-up class*: spectral methods and applications
02/09/17	*no class*
	02/03/17: hw set 2 due; projects start
02/14/17	atomistic fundamentals
02/16/17	atomistic-to-continuum coupling techniques
02/21/17	quasicontinuum methods: fundamentals
02/23/17	quasicontinuum method: local vs. nonlocal
02/28/17	atomistic-to-continuum coupling applications
03/01/17	*make-up class*: molecular dynamics
03/02/17	*no class*
03/07/17	examples of multiscale techniques
03/09/17	*project presentations*
	03/09/17: projects due

* Make-up classes are tentatively on Wednesday mornings (to be discussed in class).

Course Contents Ae/AM/CE/ME 214a (Fall 2016, tentative list of topics)

Function spaces, linear spaces. Variational principles. Finite element analysis. Variational problems in linear and finite kinematics. Time integration, initial boundary value problems. Elasticity and inelasticity. Constitutive modeling. Error estimation. Accuracy, stability and convergence. Iterative solution methods. Adaptive strategies.

Course Contents Ae/AM/CE/ME 214b (Winter 2017, tentative list of topics)

Multiscale modeling strategies. Computational homogenization in linear and finite kinematics. Spectral methods. Atomistic modeling and atomistic-to-continuum coupling techniques.