جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Seismic Imaging - ErSE 260

Division	Physical Science and Engineering Division
Course Number	ErSE 260
Course Title	Seismic Imaging
Academic Semester	Spring
Academic Year	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
Class Schedule (Days & Time)	01:00 PM - 02:30 PM | Mon Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Tariq Ali Alkhalifa	tariq.alkhalifah@kaust.edu.sa	+966128080282		Monday & Wednesday 01:00pm - 02:30pm

Teaching Assistant(s)

Name	Email
Qiang Gou	qiang.guo@kaust.edu.sa

Course Information

Comprehensive Course Description	We introduce the concept of seismic imaging in the framework of wavefield extrapolation and the imaging condition. We look at the various migration methods including Kirchhoff, phase-shift migration, Downward continuation methods, reverse time migration and others. We look at the impact of velocity and the role of imaging in estimating the velocity model.
Course Description from Program Guide	This course is devoted to studying the concept of seismic imaging for exploration purposes. We introduce seismic imaging in the framework of Greens functions and wavefield extrapolation and discuss the various imaging conditions. We look at the various migration methods including Kirchhoff, phase-shift migration, Downward continuation methods, reverse time migration, and others. We discuss the role that velocity plays in the seismic imaging process.

Goals and Objectives	To understand and learn the fundamentals of seismic imaging and physical and mathematical framework behind its many concepts. with objectives to learn: -Wave propagation -High frequency asymptotics. -The concept of Seismic imaging. -Integral migration methods. -Fourier-based methods. -Prestack depth migration. -The role of velocity. -The double square formulation. -Sage
Required Knowledge	Seismology 1 and reasonable math, specifically PDE and linear Algebra
Reference Texts	Class notes (CN) + Theory of Seismic Imaging (TSI) by John Scales The book can be downloaded freely from Samizdat Press http://samizdat.mines.edu/imaging/ **Additional References:** *Imaging the Earth Interior* by Jon Claerbout can be downloaded freely from http://sepwww.stanford.edu/sep/prof/iei/toc_html/
Method of evaluation	**35.00**% - Final exam **15.00**% - Midterm exam **50.00**% - Homework /Assignments
Nature of the assignments	Exams will represent 50% of the final course grade. There will be one midterm exam and one (final) exam in the lecture part of the course. Homework and a final project will represent the remaining 50% of the final course grade and will consist of a series of homework exercises designed to help you learn the essence of seismic imaging. Individual homework exercises (10%) will be designed to complement our progress in class and it will include codes to achieve parts of what learned. These exercises are preparatory for the understanding of the concept that is compiled into a final formally written report (40%) that will be submitted at the end of the course.
Course Policies	Late homework submissions -20% of the homework grade up to a week after the deadline.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Mon 01/29/2018	Introduction to Seismic Imaging
1	Wed 01/31/2018	Introduction to Seismic Imaging
2	Mon 02/05/2018	Wavefields and Wave propagation
2	Wed 02/07/2018	Wavefields and Wave propagation
3	Mon 02/12/2018	Wavefields to Wavefronts
3	Wed 02/14/2018	Wavefields to Wavefronts
4	Mon 02/19/2018	Modeling and the forward problem-exploding reflector
4	Wed 02/21/2018	Modeling and the forward problem-exploding reflector
5	Mon 02/26/2018	The concept of seismic imaging- the adjoint and the imaging condition
5	Wed 02/28/2018	The concept of seismic imaging- the adjoint and the imaging condition
6	Mon 03/05/2018	Integral Imaging methods - Kirchhoff
6	Wed 03/07/2018	Integral Imaging methods - Kirchhoff
7	Mon 03/12/2018	Modeling in time and frequency
7	Wed 03/14/2018	Modeling in time and frequency
8	Mon 03/19/2018	Time migration and Zero-offset to Prestack
8	Wed 03/21/2018	Time migration and Zero-offset to Prestack
9	Mon 03/26/2018	Imaging in the Fourier domain
9	Wed 03/28/2018	**Midterm Exam**
10	Mon 04/02/2018	Spring break
10	Wed 04/04/2018	Spring break
11	Mon 04/09/2018	Wave equation methods and Downward continuation
11	Wed 04/11/2018	Wave equation methods and Downward continuation
12	Mon 04/16/2018	Reverse time migration (RTM)
12	Wed 04/18/2018	Reverse time migration (RTM)
13	Mon 04/23/2018	The DSR formulation
13	Wed 04/25/2018	The DSR formulation and the velocity issue
14	Mon 04/30/2018	The velocity issue, image/angle gathers
14	Wed 05/02/2018	waveform inversion
15	Mon 05/07/2018	waveform inversion 2
15	Wed 05/09/2018	Imaging issues
16	Mon 05/14/2018	Velocity model building issues
16	Wed 05/16/2018	Review
17	Mon 05/21/2018	Final exam
17	Wed 05/23/2018	**Final exam**

Note

The instructor reserves the right to make changes to this syllabus as necessary.