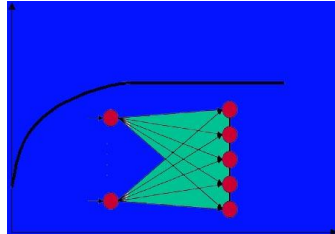


# EAGE

EUROPEAN ASSOCIATION OF GEOSCIENTISTS & ENGINEERS



GeoNeurale

EAGE Education Tour 13 Munich

*Velocities, Imaging, and Waveform Inversion – The Evolution of Characterizing the Earth's Subsurface*

**Dr. Ian Jones**

**18.12.2018**

**9:00 – 16:00**

**Conference Center - Forum Fürstenfeld**

**Room S6**

**Munich – Fürstenfeldbruck**

**Germany**



## *Velocities, Imaging, and Waveform Inversion - The Evolution of Characterizing the Earth's Subsurface*

Ian Jones' two-day course 'An introduction to migration and velocity model building' covers much of the ground that this EET will cover, as does Etienne Robein's EET 4 course on imaging, Tariq Alkhalifah's EET10 course and Jean Virieux' SEG DL course on FWI. However, this new EET will be a fusion of the practical industrial elements of the above courses, concentrating on the origin and nature of the geological complexities that give-rise to imaging problems, as well as a physical (rather than mathematical) understanding of subsurface parameter estimation, and will also look at some possible future directions.

The course is designed for: practising geoscientists who desire to better understand the principles and limitations of both current and emerging technologies involved in subsurface parameter estimation and imaging, and geoscience students. Following this course, participants should ideally understand how contemporary velocity estimation methods work, and what approximations are involved in obtaining computationally tractable solutions.

In using sound waves to characterize the Earth's subsurface, we can employ ray-theory and/or wave-theory, and both migration algorithms and parameter estimation schemes employ one or other of these theoretical descriptions. In this course, we'll review the evolution of the industry's approaches to building earth models via velocity estimation and imaging, outlining the evolution from ray tomography to full waveform inversion, and look towards the emerging possibilities for replacing imaging techniques with direct subsurface parameter inversion methods.

The approach will be mostly non-mathematical, concentrating on an intuitive understanding of the principles, demonstrating them via case histories, and will be divided into the following sections:

- dealing with the near surface
- the effects of strong vertical velocity contrasts
- the effects of strong lateral velocity contrasts
- waves versus rays
- model building using ray methods (tomography)
- model building using wavefield extrapolation methods (FWI)
- data examples and comparisons
- future developments

The first three sections outline the nature of the problems we face when building images representing subsurface impedance contrasts, and the next three deal with the technology we deploy to address the problems. In addition, I've included three appendices to outline: the historical development of model building; anisotropy; and pre-processing considerations for complex imaging. Several of the individual chapters build on a series of recent tutorial papers which I published in First Break. However, only the key points from these tutorial papers are included, so I refer readers to the original papers for more detail and/or a range of real data examples for each of their topics.

Due to space and time constraints in the EET format, Ian Jones had to omit or limit coverage of various topics, including: migration of multiples, Marchenko and inverse scattering series migration, joint migration-inversion, least-squares migration, and uncertainty estimation.

#### Participants' profile

The course is designed for practising geoscientists who desire to better understand the principles and limitations of both current and emerging technologies involved in subsurface parameter estimation and imaging, and geoscience students.

#### Prerequisites

A general knowledge of geophysics.

### About the instructor



**Ian Jones** received a joint honours BSc in Physics with Geology from the University of Manchester, UK, in 1977, an MSc in Seismology from the University of Western Ontario, Canada, and a PhD in Geophysical Signal Processing from the University of British Columbia, Canada. After working for 'Inverse Theory & Applications Inc.' in Canada for two years, he joined CGG, where for 15 years he was involved in R&D in the London and Paris offices, latterly as manager of the depth imaging research group. Since 2000 he has been with ION GX Technology, as a Senior Geophysical Advisor in their London office.

His interests cover velocity model building and migration, and his publications include the chapter on model building in the new SEG online encyclopaedia; the text book 'An Introduction to Velocity Model Building' published by the EAGE in 2010; and the coedited SEG Geophysics Reprints series volumes 'Classics of Elastic Wave Theory' and 'Pre-Stack Depth Migration and Velocity Model Building'.

He is an associate editor for the journals 'Geophysics' and 'Geophysical Prospecting', and teaches the EAGE/SEG continuing education course on 'Velocity Model Building' and is an external lecturer at the University of Leeds and Imperial College London. Ian was awarded the EAGE's Anstey Medal in 2003 for contributions to the depth imaging literature, made the SEG European Honorary Lecturer in 2012, and has recently been nominated to conduct the international 2018 EAGE Education Tour.

# EAGE

## EAGE Education Tour 13 Munich

The venue for this event will be the new **GeoNeurale** training location situated in the historical Fuerstenfeld Forum.

The Cistercian monastery at Fuerstenfeld was founded in 1263 like a castle structure. It was restored in 2001 and a modern conference center has been built into the historic monastery grounds preserving the original wooden made architectures.



The conference center disposes of free parking facilities and can be easily reached with the underground line S4 going westwards from the Munich central railway station in about 25 minutes plus 5 minutes walk to the conference complex. The main entrance is situated on the right front building (red arrow) and will be marked by information signals.



<https://www.fuerstenfeld.de/architecture>

For **room S6** follow the info direction on location.



## ONLINE REGISTRATIONS

<https://events.eage.org/en/2018/eet-13-2018-munich>

List Price

Euro 150

Member Price

Euro 75

Student Price

Euro 25 Discount on course fees

# INFORMATIONS

EAGE

[www.eage.org](http://www.eage.org)

GeoNeurale

<http://www.geoneurale.com/contact.htm>

**GeoNeurale**  
Administration  
Am Nymphenbad 8  
81245 Munich - Germany  
info@GeoNeurale.com  
www.GeoNeurale.com

T +49 (0)89 89691118  
F +49 (0)89 89691117