

TALK ABSTRACTS

Industrial Talk I

Automation in Seismic Interpretation

Speaker: Dr. Nasher AlBinHassan

Abstract:

Some aspects of 3D seismic interpretation can be performed automatically by computers. Two essential interpretation procedures are picking of horizons and faults. We will show that all horizons can be picked automatically via an inversion algorithm without any human intervention. Moreover, we introduce a new method which processes 3D seismic volumes and generates images of fault likelihood and corresponding fault-plane. Based on these fault attributes, fault surfaces can be tracked automatically. Instead of picking horizons based on amplitudes of seismic cubes, local dips of seismic events are computed and inverted for 3D curved time surfaces; each of these surfaces corresponds to a specific geological deposition time. The inversion will yield thousands of such geological time horizons, unlike the few picked horizons available from manual seismic interpretation. In addition to the inversion of horizons, we have employed a novel edge detection technology to calculate fault-related attributes, including the fault likelihood and fault-plane orientations. The new technology can reduce the noise resulting from conventional coherency-based methods. These enhancements are achieved by scanning among all possible fault angles and generating the most likely fault attributes. These tools enable 3D seismic interpretation to be completed in a much reduced cycle time. It also allows interpreters to have a quick overview of the depositional history and fault networks. With this type of automation, human bias is also minimized and thus reduction of potential errors when interpreting seismic volumes is readily achieved.

CeGP Research Project

Microseismic Signal Enhancement and Arrival Time Picking Correction

Speaker: Dr. Abdullatif Al-Shuhail, Dr. Entao Liu

Abstract:

Passive microseismic data are commonly buried in noise, which presents a significant challenge in microseismic data analysis and event detection. In this talk, we consider the situation where a sensor array provides multiple traces that each contain an arrival from the event, and propose an autocorrelation-based method that designs a denoising filter which is then applied to all the traces to facilitate the following processing. The cross-correlation with the reference trace is a widely adopted approach for arrival time picking in microseismic data processing. However, when the SNR is low, the result is not satisfactory. We proposed an effective scheme of arrival time picking correction method which is based on the stacked cross-correlation. This method is validated to be efficient and robust with both synthetic and real data.

Academic Talk I

Efficient Under-sampled High Resolution Radon transform

Dr. Wail Mousa,

Abstract:

Radon transform has been widely utilized for seismic data processing and is part of the seismic workflow for the last a few decades. It is robust, easier to compute, well established mathematical theory, and faster method to compute it. This talk presents a new method for the parabolic Radon transform that results in an under-sampled high resolution Radon transform. The method is based on a non-linear sampling technique, known as compressive sensing. The proposed method was applied for the attenuation of multiple reflections from the recorded seismic data which is one of the key issues in the field of seismic data processing. It is believed that the proposed method is an appropriate new addition to the existing methods for efficient high resolution sparse Radon transform computation.



Industrial Talk II

The Role of Seismic Technology in the Characterization of Unconventional Reservoirs

Speaker: Dr. Mohammed Badri,

Abstract:

The seismic technology has dramatically changed the landscape of exploration and development of the subsurface since the introduction of 3D Seismic acquisition and processing. In recent years, the exploration and exploitation of unconventional resources brought the seismic imaging technology to new challenges given the need for reliable and accurate reservoir characterization. Extraction of reservoir properties such as fracture network, geomechanical properties, and lithology elements require broad band seismic data that includes low frequency below 3 Hz and high channel count and single sensor technology to provide the capabilities to identify sweet spots. Seismic multiples, near surface effect, velocity models and anisotropy are some of the challenges that face geophysicists in the region that they have to deal with. Wide azimuth seismic data acquisition and low frequency containment are necessary technologies to improve the imaging and characterization of deep gas reservoirs. Microseismic monitoring of hydraulic fracturing and the ability to provide reliability and efficiency to operation execution is of paramount importance.

In this presentation I will highlight the challenges that the industry is facing which will provide opportunities for research and development of seismic algorithms to address these challenges.

CeGP Research Project

In-Field Intelligent Seismic data compression using Distributed PCA

This work considers seismic data compression for intelligent sensor networks.

First of all, the probability density function (PDF) mixture is applied to model the traces collected by a sensor network. The traces from each sensor are modeled as the realizations following an unknown PDF, thus all traces are modeled as the realizations following a PDF, which is described as a convex sum of the local PDFs.

Secondly, based on this modeling, a distributed (Principal Component Analysis) PCA scheme is proposed. In the proposed scheme, each sensor sends its local statistics, i.e., local mean, local covariance and the number of traces, to a fusion center. The fusion center receives all local statistics and calculates the global covariance. Then, a set of global (Principal Components) PCs are determined and broadcasted back to the sensors for projection.

Furthermore, the practical layout of sensors is also considered. The practical layout is decomposed into two fundamental topologies and two communication schemes are designed accordingly for them, respectively. By implementing these two schemes to the practical layout of sensors, the distributed PCA technique is easily applied.

Finally, an analysis is presented, both theoretically and numerically, to evaluate the performance of the proposed distributed PCA scheme compared with the widely used local PCA scheme. The results show that the proposed scheme has a significant advantages on the implementation simplicity.

Academic Talk II

Title: Real-time wireless seismic data acquisition

Abstract:

There has been recently a clear inclination in the onshore seismic industry towards scaling up the swath sizes of surveyed areas. Such a trend is consistently associated with a demand by end-users for higher survey resolutions which is manifested in the deployment of more geophones per unit area. It is also manifested in higher sampling rates consequently generating a "data tsunami". In this talk, we advocate the use of wireless technology as a viable tool for lowering survey OPEX. We first motivate the value proposition of wireless data acquisition in comparison to cabled solutions. We then offer a wide-angle view of various flavors of wireless seismic data acquisition solutions while pinpointing their shortcomings, particularly in terms of reliability, timeliness, and scalability. Based on analytical results obtained, a 20-unit proof-of-concept (PoC) test-bed was built at KAUST. The talk is concluded with an insight into potential commercialization venues for the developed real-time wireless technology.