Multichannel Analysis Of Surface Waves Masw Active And

Written for practicing geophysicists, “Land Seismic Case Studies for Near-Surface Modeling and Subsurface Imaging” is a comprehensive guide to understanding and interpreting seismic data. The culmination of land seismic data acquisition and processing projects conducted by the author over the last two decades, this book contains more than nearly 800 figures from worldwide case studies—conducted in both 2D and 3D. Beginning with Chapter 1 on seismic characterization of the near-surface, Chapter 2 presents near-surface modeling by traveltime and full-wave inversion, Chapter 3 presents near-surface modeling by imaging, and then Chapter 4 includes detailed case studies for near-surface modeling. Chapter 5 reviews single- and multichannel signal processing of land seismic data with the key objective of removing surface waves and guided waves that are characterized as coherent linear noise. Uncommon seismic data acquisition methods, including large-offset acquisition in thrust belts to capture the large-amplitude supercritical reflections, swath-line acquisition, and joint PP and SH- SH seismic imaging are highlighted in Chapter 6, and Chapter 7 presents image-based rms velocity estimation and discusses the problem of velocity uncertainty. The final two chapters focus exclusively on case studies: 2D in Chapter 8 and 3D in Chapter 9. An outstanding teaching tool, this book includes analysis workflows containing processing steps designed to solve specific problems. Essential for anyone involved in acquisition, processing, and inversion of seismic data, this volume will become the definitive reference for understanding how the variables in seismic acquisition are directly reflected in the data.

This radical revision of Professor Bullen's acclaimed and widely used text provides an introduction to modern seismological theory, with emphasis on both the physical models and the mathematical descriptions of earthquakes and their sources. The essential core of the earlier editions has been retained, particularly the tensor treatment of elasticity, seismic wave travel-time analysis and density in the Earth, although these parts of the text have been brought up to date and expanded. The new part of the book reflects on how the study of earthquakes, seismic waves and seismic risk has been broadened in the past two decades. Thus, this edition includes introductory theory of earthquake sources, seismic wave travel through complex geological zones and viscous and anisotropic media, vibrations of the whole Earth, strong-motion seismology and earthquake prediction and risk. There is an emphasis on statistical and numerical procedures and problems of resolution in inverse theory. Modern class exercises are to be found throughout. The book assumes some background in classical physics and mathematics, including simple differential equations, linear algebra and probability theory. It will be suitable for use in undergraduate courses in geophysics, applied mechanics and geotechnology and for graduate courses in seismology and earthquake engineering. In addition, it will serve as a reference text on seismological problems for professionals concerned with earthquakes, Earth structure and wave motion.

This volume on “Advancement in the Design and Performance of Sustainable Asphalt Pavements” includes a collection of research and practical papers from an international research and technology activities on Mixture Design Innovation, Structural Pavement Design, Advancement in Production and Construction, Climate Changes and Effects on Infrastructure, Green Energy, Technology and Integration. The volume constitutes an important contribution in view of the urgent need to develop materials, designs, and practices to ensure the sustainability of transportation infrastructure. This volume is part of the proceedings of the 1st GeoMEast International Congress and Exhibition on Sustainable Civil Infrastructures, Egypt 2017.

This book bridges the gap between theory and practice, showing how a detailed definition of the shear-wave velocity (VS) profile can be efficiently obtained using limited field equipment and following simple acquisition procedures. It demonstrates how surface waves (used to define the VS profile) and vibration data (used to describe the dynamic behaviour of a building) can be recorded using the same equipment, and also highlights common problems, ambiguities and pitfalls that can occur when adopting popular methodologies, which are often based on a series of simplistic assumptions. Today, most national and international building codes take into account a series of parameters aimed at defining the local seismic hazard. Sites are characterised based on the local VS profile, and the dynamic behaviour of existing buildings is defined through the analysis of their eigenmodes. The book includes a series of case studies to help readers gain a deeper understanding of seismic and vibration data and the meaning (pros and cons) of a series of techniques often referred to as MASW, ESAC, SPAC, ReMi, HVSR, MAAM and HS. It also provides access to some of the datasets so that readers can gain a deeper and more concrete understanding of both the theoretical and practical aspects.

Develop a Greater Understanding of How and Why Surface Wave Testing Works Using examples and case studies directly drawn from the authors’ experience, Surface Wave Methods for Near-Surface Site Characterization addresses both the experimental and theoretical aspects of surface wave propagation in both forward and inverse modeling. This book accents the key facets associated with surface wave testing for near-surface site characterization. It clearly outlines the basic principles, the theoretical framework and the practical implementation of surface wave analysis. In addition, it also describes in detail the equipment and measuring devices, acquisition techniques, signal processing, forward and inverse modeling theories, and testing protocols that form the basis of modern surface wave techniques. Review Examples of Typical Applications for This Geophysical Technique Divided into eight chapters, the book explains surface wave testing principles from data measurement to interpretation. It effectively integrates several examples and case

studies illustrating how different ground conditions and geological settings may influence the interpretation of data measurements. The authors accurately describe each phase of testing in addition to the guidelines for correctly performing and interpreting results. They present variants of the test within a consistent framework to facilitate comparisons, and include an in-depth discussion of the uncertainties arising at each stage of surface wave testing. Provides a comprehensive and in-depth treatment of all the steps involved in surface wave testing Discusses surface wave methods and their applications in various geotechnical conditions and geological settings Explains how surface wave measurements can be used to estimate both stiffness and dissipative properties of the ground Addresses the issue of uncertainty, which is often an overlooked problem in surface wave testing Includes examples with comparative analysis using different processing techniques and inversion algorithms Outlines advanced applications of surface wave testing such as joint inversion, underwater investigation, and Love wave analysis Written for geotechnical engineers, engineering seismologists, geophysicists, and researchers, Surface Wave Methods for Near-Surface Site Characterization offers practical guidance, and presents a thorough understanding of the basic concepts.
"Many blasting applications in the mining industry demand that the hard rock being blasted remains structurally competent. For example, pre-splitting is a common technique to reduce fracturing, and operators of dimension stone quarries use this blasting method to eliminate overbreak. When pre-split design parameters are not applied correctly, there will be a redistribution of stresses within the rock, resulting in Blast Induced Rock Damage (BID). Advances in geophysical technology are enabling blast technicians to monitor BID and then use the results to correctly design their blasts. The Multichannel Analysis of Surface Waves (MASW) geophysical method is new technology that is applied in many industries to determine the structural integrity of the subsurface. However, it has never been applied to monitor and quantify BID. Nonetheless, the author of this research intended to determine whether the MASW geophysical method can be applied on a large scale in surface mining by quantifying the amount of BID that is produced from pre-splitting and comparing this BID to rock mass competency, and high-wall stability. The author did so by performing a series of pre-split shots at a sandstone dimension stone quarry. Pre and post blast MASW surveys were gathered and compared to determine the extent that unwanted damage was occurring from the pre-split at specific depth intervals from the split line. The MASW method will produce high resolution data when it is used in optimal conditions. However, geological anomalies that are typical at mine sites prevent accurate MASW data to be processed with high resolution. Therefore, MASW is not applicable to monitor BID produced from pre-splitting with precision. However, MASW is capable of collecting detailed information at mine sites when it is performed on a large scale and this research shows that it will identify zones where the stone has been disturbed from the blast at depths several meters from the split line which

compromises the structural integrity of the remaining rock mass and negatively influences the outcome of later shots performed in that area. This research generated recommendations for work that could be done to further utilize the MASW method as it was intended for"--Abstract, leaf iii.

Proceedings of the Fifth International Conference on Geotechnical and Geophysical Site Characterisation (ISC?5) held from September 5th to 9th 2016, Gold Coast, Australia

Advances in Near-surface Seismology and Ground-penetrating Radar (SEG Geophysical Developments Series No. 15) is a collection of original papers by renowned and respected authors from around the world. Technologies used in the application of near-surface seismology and ground-penetrating radar have seen significant advances in the last several years. Both methods have benefited from new processing tools, increased computer speeds, and an expanded variety of applications. This book, divided into four sections--"Reviews," "Methodology," "Integrative Approaches," and "Case Studies"--captures the most significant cutting-edge issues in active areas of research, unveiling truly pertinent studies that address fundamental applied problems. This collection of manuscripts grew from a core group of papers presented at a post-convention workshop, "Advances in Near-surface Seismology and Ground-penetrating Radar," held during the 2009 SEG Annual Meeting in Houston, Texas. This is the first cooperative publication effort between the near-surface communities of SEG, AGU, and EEGS. It will appeal to a large and diverse audience that includes researchers and practitioners inside and outside the near-surface geophysics community. --Publisher description.

This book contains a collection of latest research developments on the urban transportation systems. It describes rail transit systems, subways, bus rapid transit (BRT) systems, taxicabs, automobiles, etc. This book also studies the technical parameters and provides a comprehensive overview of the significant characteristics for urban transportation systems, including energy management systems, wireless communication systems, operations and maintenance systems, transport serviceability, environmental problems and solutions, simulation, modelling, analysis, design, safety and risk, standards, traffic congestion, ride quality, air quality, noise and vibration, financial and economic aspects, pricing strategies, etc. This professional book as a credible source can be very applicable and useful for all professors, researchers, students, experienced technical professionals, practitioners and others interested in urban transportation systems.

Limits and Ability of the Multichannel Analysis of Surface Waves Method to Detect and Resolve Subsurface Anomalies

The scope of engineering seismology includes geotechnical site investigations for buildings and engineering infrastructures, such as dams, levees, bridges, and tunnels, landslide and active-fault investigations, seismic microzonation, and geophysical investigations of historic buildings. These projects require multidisciplinary participation by the geologist, geophysicist, and geotechnical and earthquake engineers. A key objective of this book (SEG Investigations in Geophysics Series No. 17) by Öz Yilmaz is to encourage the specialists from these disciplines to apply the seismic method to solve the many challenging engineering problems they face. The broader scope of engineering seismology also includes exploration of earth resources, including groundwater exploration, coal and mineral exploration, and geothermal exploration. While focusing on the application of the seismic method to geotechnical site investigations, this book includes many case studies in all of the applications of engineering seismology.

The ongoing population growth is resulting in rapid urbanization, new infrastructure development and increasing demand for the Earth's natural resources (e.g., water, oil/gas, minerals). This, together with the current climate change and increasing impact of natural hazards, imply that the engineering geology profession is called upon to respond to new challenges. It is recognized that these challenges are particularly relevant in the developing and newly industrialized regions.The idea beyond this Volume is to highlight the role of engineering geology and geological engineering in fostering sustainable use of the Earth's resources, smart urbanization and infrastructure protection from geohazards. We selected 19 contributions from across the globe (16 countries, five continents), which cover a wide spectrum of applied interdisciplinary and multidisciplinary research, from geology to engineering. By illustrating a series of practical case studies, the Volume offers a rather unique opportunity to share the experiences of engineering geologists and geological engineers who tackle complex problems working in different environmental and social settings. The specific topics addressed by the papers included in the Volume are the following: pre-design site investigations; physical and mechanical properties of engineering soils; novel, affordable sensing technologies for long-term geotechnical monitoring of engineering structures; slope stability assessments and monitoring in active open-cast mines; control of environmental impacts and hazards posed by abandoned coal mines; assessment of and protection from geohazards (landslides, ground fracturing, coastal erosion); applications of geophysical surveying to investigate active faults and ground instability; numerical modeling of seabed deformations related to active faulting; deep geological repositories and waste disposal; aquifer assessment based on the integrated hydrogeological and geophysical investigation; use of remote sensing and GIS tools for the detection of environmental hazards and mapping of surface geology.

The purpose of this research is to establish a recommended procedure for performing multichannel analysis of surface waves (MASW) on pavements as well as evaluating the ability of MASW to detect a change in shear wave velocity as damage in concrete increases. The tests for establishing a recommended procedure for performing MASW on pavements was conducted at five sites at the University of Arkansas Engineering Research Center in Fayetteville, Arkansas. The five sites consisted of three materials: asphalt, concrete, and soil (two sites were on asphalt, two were on concrete, and one was on soil). The methods evaluated at these sites include the source type, distance from the source to the first receiver in the array (i.e., source offset), the spacing between receivers in the array, and the minimum number of receivers in the array. It was determined that for the data collected on asphalt, the optimum procedure included a 230g metal-tipped hammer, 2.5 cm receiver spacing, a minimum of 24 receivers, and source offsets of 12.5 cm, 25 cm, and 50 cm. For concrete, the optimum procedure included a 230g metal-tipped hammer, 5 cm receiver spacing, a minimum of 18 receivers, and source offsets of 12.5 cm, 25 cm, 50 cm, and 75 cm. For soil, the optimum procedure included a 230g metal-tipped hammer, 5 cm receiver spacing, a minimum of 12 receivers, and source offsets of 12.5 cm, 25 cm, and 50 cm. Additionally, it was determined from a limited data set of six tests, that MASW has the ability to detect a decrease in shear wave velocity as damage increases up to a strain level of at least 0.09%. However, MASW testing done on concrete with expansions of 0.09% and 0.29% showed only a 2% difference in shear wave velocity between the two large strain sections. Given the data collected it cannot be determined if MASW can be used to differentiate between concrete sections with strains larger than 0.09% (i.e., sections with heavy damage).

"The research presented here consists of two case studies: the first from a study site in Illinois and the second from a site in Arkansas. In both instances, geophysical investigations were conducted to characterize the subsurface. At the Illinois site, borehole control, downhole seismic (DHS), seismic refraction tomography (SRT) and multichannel analysis of surface waves (MASW) data were acquired for the purpose of seismic site characterization. Shear wave and compressional wave velocities were used to estimate depth to bedrock and to generate 1-D plots depicting variations in Poisson's Ratio, elastic moduli and density. The average shear wave velocity in the upper 100 ft was calculated and the national earthquake hazards reduction program (NEHRP) class D was assigned to the site based on MASW and DHS data results. At the Arkansas site, borehole control, electrical resistivity tomography (ERT), seismic refraction tomography (SRT), and multichannel analysis of surface waves (MASW) data were acquired with the objective of verifying and mapping a postulated fault. A comparative evaluation of the overall usefulness of the ERT, SRT and MASW techniques was also performed. The comparison showed that ERT and SRT tools generated remarkably similar images of the fault. The MASW tool generated a slightly different image of the fault. The research demonstrates that integrated use of seismic (seismic refraction tomography, multichannel analysis of surface waves and downhole seismic) and electrical (electrical resistivity tomography) methods is an effective approach in terms of assessing soil and rock in the New Madrid Seismic Zone"--Abstract, page iii.

Estimating S-wave velocities (Vs) from Rayleigh-wave velocities (VR) is widely used in field seismic testing for geotechnical engineering purposes. In this research, two widely used surface-wave methods, the Spectral-Analysis-of-Surface-Waves (SASW) and Multichannel-Analysis-of-Surface-Waves (MASW) methods, are evaluated and compared in field experiments. An experimental parametric study was undertaken of the SASW and MASW methods. Conventional seismic sources in the SASW method are sledge hammers, bulldozers and vibroseises. For MASW testing, sledge hammers and small shakers are usually used as the seismic sources. In this research, MASW testing was performed with traditional and non-traditional sources at a site owned by the City of Austin, Texas. Experimental dispersion curves and Vs profiles from SASW tests are used as references for the field parametric study with the MASW method. The source type, source offset, receiver spacing and number of receivers were varied to evaluate the impact of each variable on the field experimental dispersion curve. Two type of receivers, 1-Hz and 4.5-Hz natural-frequency geophones, were also compared in these tests. A second part of this research involved studying the use of characterizing geotechnical materials based on Vs. This work included two projects. The first project involved basalt on the Big Island of Hawaii. To develop empirical ground motion prediction models for the purpose of earthquake hazard mitigation and seismic design on the Big Island, the subsurface site conditions beneath 22 strong motion stations were investigated by SASW tests. Vs profiling was performed to depths of more than 100 ft. Vs30, the average Vs in the top 30 m, was also calculated to assign NEHRP site classes to different testing locations. Different materials, mainly thought to be stiff basalt, were characterized and grouped based on the Vs values. These groups were then compared with reference curves for sand and gravel (Menq, 2003) to differentiate the groups. The second project dealing with charactering geotechnical materials based on Vs involved of soil/rock profiles at a project site in British Columbia, Canada. The goals in terms of this research were to: (1) compare the Vs profiles from the different test locations to investigate the stiffnesses of different geologic materials, the variability in the material stiffnesses, and the estimated depth to bedrock, and (2) to compare the Vs profiles to existing geological and geotechnical information such as nearby boreholes, cone penetration tests and seismic cone penetration tests. Good agreement between SASW Vs profiles and boring records is expected when lateral variability at the site is low. However, when lateral variability is significant, then the difference between localized measurements, like borings and CPT results, and global measurements, like SASW Vs results, can further contribute to understanding the site conditions as shown at the site in British Columbia, Canada.

"Determining how a building site will respond to earthquake ground shaking plays a critical role in proper construction practices. One critical constraint on how a site responds is the near surface shear wave seismic velocity distribution. One commonly used method for indirectly estimating shear wave velocities is Multichannel Analysis of Surface Waves (MASW), which utilizes a spread of vertical geophones to measure Rayleigh wave dispersion. With this approach, phase velocity vs. frequency dispersion curve picks can be used to estimate shear wave velocities with depth. I investigate the use of two (vertical and horizontal inline) component seismic signals to record the elliptical Rayleigh wave motion for improved constraints on the phase velocity vs. frequency relationship in a process I term Multi-Component Analysis of Surface Waves (MCASW). Using MCASW allows me to better constrain Rayleigh wave dispersion at lower frequencies, leading to more accurate estimates of shear wave velocities at greater depths compared to the traditional MASW approach. I can also use multiple seismic components to determine particle motions to identify and remove select Rayleigh wave modes. I show that my polar mute approach leads to a further improvement of shear wave velocity estimates from Rayleigh wave signals."--Boise State University ScholarWorks.

Seismic Wave Analysis for Near Surface Applications presents the foundational tools necessary to properly analyze surface waves acquired according to both active and passive techniques. Applications range from seismic hazard studies, geotechnical surveys and the exploration of extra-terrestrial bodies. Surface waves have become critical to near-surface geophysics both for geotechnical goals and seismic-hazard studies. Included in this book are the related theories, approaches and applications which the lead editor has assembled from a range of authored contributions carefully selected from the latest developments in research. A unique blend of theory and practice, the book’s concepts are based on exhaustive field research conducted over the past decade from the world’s leading seismologists and geophysicists. Edited by a geophysicist with nearly 20 years of experience in research, consulting, and geoscience software development. Nearly 100 figures, photographs, and examples aid in the understanding of fundamental concepts and techniques Presents the latest research in seismic wave characteristics and analysis, the fundamentals of signal processing, wave data acquisition and inversion, and the latest developments in horizontal-to-vertical spectral ratio (HVSR). Each chapter features a real-world case study—13 in all—to bring the book’s key principles to life.

"This research investigated fractured zones leading to preferential flow paths of Wilson Spring. In this context, electrical

resistivity tomography (ERT) data and multi-channel analyses of surface waves (MASW) data were acquired at studied site with the purpose of mapping a variable depth to top of bedrock and geological structures. Interpretation of the boreholes, MASW, and ERT data indicated that a depth to top of rock does vary significantly at the studied site due to many solution-widened fractures. Multiple near-vertical solution-widened fractures were mapped in the studied site based on the interpretation of the ERT data. The mapped solution-widened fractures appear to be trending north-south, almost perpendicular to the ERT traverses (west-east), and however it is possible they extend at oblique angle to the ERT traverses. The conducted geophysical survey is the first attempt to map geological structures and karst features that might be possible access of underground water. The underground water expose on land surface through fractures to develop Wilson Spring. Thus the seepage pathway near or beneath Wilson Creek is interpreted as through a solution-widened fractures. ERT method has proven to be effective in mapping variable depth to bedrock and solution-widened fractures. The MASW method and boreholes data were able to map variable depth to top of bedrock"--Abstract, page iii.
Seismic measurements take many forms, and appear to have a universal role in the Earth Sciences. They are the means for most easily and economically interpreting what lies beneath the visible surface. There are huge economic rewards and losses to be made when interpreting the shallow crust or subsurface more, or less accurately, as the case may be.
"This study was designed to verify the effects and data reproducibility when the length of receiver array, receiver spacing, source offset and array orientation parameters are changed for data acquired using multichannel analysis of surface waves (MASW), at intended target depth of 30ft (9m), and to compare the results with electrical resistivity tomography (ERT) data obtained for the same study site. The MASW data acquired for 34 sites, along four profiles for each site using variable source offsets of 10ft (3m) and 30ft (9.1m), and variable receiver spacings of 2.5ft (0.76m) and 5.0ft (0.76m), concurrently. Out of the 272 profiles studied, 136 profiles were oriented east-west, and 136 profiles were oriented north-south. The MASW data was used in conjunction with ERT data to ensure the accuracy of the ERT data. The comparative analysis indicated the profile configuration measurements have significant influence on the quality of the data and that the best inversion analysis is obtained when the dispersion curves are created using the north-south oriented arrays. The MASW survey study concluded that the most consistent and beneficial karst terrain dispersion images were those obtained from the predicted optimal acquisition, using receiver spacing (dx) = 2.5ft, source offset (X1) =10ft and depth of investigation of about 30ft"--Abstract, page iii.
Highway engineering is an engineering discipline branching from civil engineering that involves the planning, design, construction, operation, and maintenance of roads, bridges, and tunnels to ensure safe and effective transportation of people and goods. The book Highway Engineering includes the main topics and the basic principles of highway

engineering and provides the full scope of current information necessary for effective and cost-conscious contemporary highway. The book reflects new engineering and building developments, the most current design methods, as well as the latest industry standards and policies. This book provides a comprehensive overview of significant characteristics for highway engineering. It highlights recent advancements, requirements, and improvements and details the latest techniques in the global market. Highway Engineering contains a collection of the latest research developments on highway engineering. This book comprehensively covers the basic theory and practice in sufficient depth to provide a solid grounding to highway engineers. This book helps readers maximize effectiveness in all facets of highway engineering. This professional book as a credible source and a valuable reference can be very applicable and useful for all professors, researchers, engineers, practicing professionals, trainee practitioners, students, and others interested in highway projects.

This volume presents select papers presented at the 7th International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics. The papers discuss advances in the fields of soil dynamics and geotechnical earthquake engineering. A strong emphasis is placed on connecting academic research and field practice, with many examples, case studies, best practices, and discussions on performance based design. This volume will be of interest to researchers and practicing engineers alike.

Theories of surface waves develop since the end of XIX century and many fundamental problems like existence, phase and group velocities, attenuation (quality factor), mode conversion, etc. have been, in part successfully, solved within the framework of such simple models as ideal fluids^ or linear elasticity. However, a sufficiently complete presentation of this subject, particularly for solids, is still missing in the literature. The sole exception is the book of I. A. Viktorov^ which contains an extensive discussion of fundamental properties of surface waves in homogeneous and stratified linear elastic solids with particular emphasis on contributions of Russian scientists. Unfortunately, the book has never been translated to English and its Russian version is also hardly available. Practical applications of surface waves develop intensively since a much shorter period of time than theories even though the motivation of discoverers of surface waves such as Lord Rayleigh stems from their appearance in geophysics and seismology. Nowadays the growing interest in practical applications of surface waves stem from the following two main factors: surface waves are ideal for developing relatively cheap and convenient methods of nondestructive testing of various systems spanning from nanomaterials (e.g.

The United States Navy (USN) currently utilizes a Rapid Penetration Test (RPT) on both land and in water as the means to determine whether sufficient soil bearing capacity exists for piles in axial compression, prior to construction of the Elevated Causeway System (Modular) [ELCAS(M)] pile-supported pier system. The USN desires a replacement for the

RPT because of issues with the method incorrectly classifying soils as well as the need to have a less labor-and-equipment-intensive method for geotechnical investigation. The Multichannel Analysis of Surface Waves (MASW) method is selected herein as the potential replacement for the RPT. The MASW method is an existing, geophysical method for determining soil properties based upon the acquisition and analysis of seismic surface waves used to develop shear wave velocity profiles for the soils at specific sites. Correlations between shear wave velocity and Cone Penetration Testing are utilized to classify soils, develop pile blow count estimates, and calculate soil bearing capacity. This researcher found that the MASW method was feasible and reliable in predicting the required properties for terrestrial sites. However, it was not successful in predicting those properties for underwater marine sites due to issues with equipment and field setup. Future areas of improvement are recommended to address these issues and, due to the success of the method on land, it is expected that once the issues are addressed the MASW method will be a reliable replacement for the RPT method across the entire subaerial and subaqueous profile.

Surface waves propagating in a medium provide information about the mechanical properties and condition of the material. Variations in the material condition can be inferred from changes in the surface wave characteristics. Multichannel analysis of surface waves (MASW) is a well-established surface wave method used for determination of the shear-wave profile of the soil layers near the surface. The MASW test configuration is also applicable to assess the condition of construction materials using appropriate frequency range. Previous studies on the detection of surface-breaking cracks in concrete elements, using the dispersion and attenuation of ultrasonic waves, were successful; however, a complete damage assessment of the whole element was not in the scope of these studies. In this study, different wave characteristics, such as Rayleigh wave velocity, wave attenuation, and phase velocity dispersion, are investigated to evaluate their sensitivity to the damage in a medium. The condition of a test specimen, which is a half-space medium made of cement and sand, is evaluated using ultrasonic transducers for different damage cases. The recorded signals are processed using the Fourier and wavelet transforms to determine the surface wave characteristics. A new dispersion index (DI) is introduced, which represents the global correlation between the dispersion of phase velocity and damage level. All features are found to be capable of reflecting the damage in the test medium with different levels of sensitivity. Among the investigated parameters, the proposed dispersion index shows high sensitivity and linear correlation with the damage.

"The Missouri Department of Transportation (MoDOT) routinely acquires seismic cone penetrometer (SCPT) shear wave velocity control as part of the routine investigation of soils at highway structures or other geotechnical sites within the Mississippi Embayment. In an effort to ensure their geotechnical investigations are as effective and efficient as possible, the SCPT tool and several available alternatives (crosshole: CH; multichannel analysis of surface waves: MASW; and refraction microtremor: ReMi) were evaluated and compared on the basis of the interpretation of processed field data acquired at two test sites in the Poplar Bluff area, southeast Missouri. These four methods for determining the shear wave velocity of soils were subsequently ranked in terms of accuracy, functionality, cost effectiveness, other considerations and overall utility. On the basis of the comparative analyses, it is concluded that MASW data are generally more reliable than SCPT data, comparable to quality ReMi data and only slightly less accurate than CH data. However, MASW's other advantages generally make it a superior choice over the other methods for general soil classification purposes to depths of 100 ft. (as per NEHRP recommendations)"--Abstract, leaf iii.

Shows that developments in seismic interferometry - the methodology of generating new seismic responses by crosscorrelation - have taken an enormous flight since the beginning of this century. In 2006, the editors of this volume compiled a supplement to Geophysics dedicated to this new branch of science. The 22 papers of the well-received supplement (recognized by one award for best paper and two honorable mentions for best paper in Geophysics and more than 100 citations in the first 20 months) form the basis for this reprint volume. The editors have added 50 papers from SEG and other journals, including Science, Physical Review, and Geophysical Research Letters. The book contains an editors' introduction with extensive references and chapters on seismic interferometry without equations, highlights of the history of seismic interferometry from 1968 until 2003, and a more detailed overview of the rapid developments since 2004. Seismic Interferometry is an invaluable source for researchers and students interested in the theory and applications of interferometry in geophysical exploration (seismic and EM), seismology, ultrasonics, and underwater acoustics.

"Multichannel Analysis of Surface Waves (MASW) and Electrical Resistivity Tomography (ERT) data were acquired in the Newburg, Missouri with the goal of determining optimum MASW acquisition parameters. Users of the MASW tool generally state that greater geophone intervals and greater shot-to-receiver offsets provide for more accurate results. The objective was to determine if this "rule of thumb" applies in karst terrain. ERT data were acquired along four traverses with eighty-four (84) electrodes at five feet spacing with SuperSting R8 Resistivity System using dipole- dipole array. The data were processed using Earth Imager to generate 2-D resistivity inversion and thereafter, Voxler software was used to collate the 2-D ERT data into a 3-D resistivity model. MASW data on the other hand, were acquired along the same ERT traverses on the same locations using a suite of different geophone intervals (1-ft, 2.5-ft, 5-ft, 7.5-ft, and 10-ft) and shot-to-receiver spacings (0-ft, 10-ft, 20-ft, 30-ft, 40-ft, and 50-ft) with a 20lb sledge hammer as the source. The data were processed using Surfseis software to generate the dispersion curves and 1-D shear wave velocity profiles of the area. On the basis of the comparative analyses of the ERT and MASW data, it was determined that 2.5-ft and 5-ft geophone gave generated depth of bedrock that was consistent with ERT data. With 5-ft geophone spacing it is possible to image the subsurface to greater depth, but with the 7.5-ft and 10-ft, unidentifiable dispersion curves would be generated. Therefore, in this study area, on the basis of data that were acquired it is recommended that 2.5ft spacing be used if depth of investigation is about 40ft, but if the depth of investigation is about 80-ft, using a sledge hammer source then 5-ft geophone spacing at 20-ft shot-receiver offset distance is recommended."--Abstract, page iii.

The multichannel analysis of surface waves (MASW) method is a non-invasive surface wave method used to characterize the layering and stiffness of the subsurface. This study assesses the practical limitations of using the MASW method for detecting and resolving subsurface anomalies. The sensitivity of MASW dispersion data to the presence of subsurface anomalies is examined through various two-dimensional (plane-strain) finite-difference elastic wave-propagation simulations. These simulations were performed on models containing anomalies of varying size, stiffness, and depth. The misfit between the dispersion data from a model with an anomaly (treatment model) and the same model without an anomaly (control model) were compared as a quantitative means of discerning if the anomaly was reliably detectable (i.e., outside the bounds of common dispersion data uncertainty). Those models categorized as containing a detectable anomaly, based on their experimental dispersion data, were further studied to determine if the dispersion data could be inverted to accurately resolve the anomaly’s size, stiffness, and depth. To rigorously perform the inversions, the procedures recommended by the surface wave inversion workflow SWinvert were adopted. These inversion procedures involve using multiple large-scale global-search inversions to address the problem’s non-linearity and multiple layering parameterizations to address the problem’s non-uniqueness. Following the inversion process, the shear wave velocity (Vs) profiles from the single “best” trial model associated with each layering parameterization were compared to the 1D Vs profiles from the centerline of the true/control model using an error function to quantitatively assess the ability of the MASW method to accurately resolve subsurface anomalies. In this study, anomalies with lateral extents less than approximately 1?2 the MASW array length located at depths greater than 5 m could not be resolved accurately by using MASW, even when the anomalies were relatively thick (> 2 m) and the impedance contrasts were notably high (> 2). The ability of MASW to detect an anomaly of a given size, stiffness, and depth is summarized in normalized figures, which are intended as a feasibility tool for those seeking to use MASW for anomaly detection

The Multichannel Analysis of Surface Waves (MASW) method traditionally uses an array of collinear vertical geophones to measure seismic wave propagation velocity at discrete points along the ground surface. Distributed fiber optic sensors (FOS) measure the average longitudinal strain over discrete lengths (i.e., zones) of a buried fiber optic cable. Such strain measurements can be used to assess ground motion and thus analyzed with the MASW method. To evaluate the feasibility of using FOS strain measurements in the MASW method, field experiments were conducted with both FOS and surface vertical geophones. Synthetic seismograms were also used to compare FOS to vertical and horizontal geophones and investigate the effect of installation depth and sensor type. Through the MASW method, shear wave (Vs) profiles from the FOS showed comparable results to those obtained with the geophones and achieved the same degree of uncertainty from the non-uniqueness of the MASW inversion process.

Characterization of the near-surface is important in identifying shallow properties and structures. In this dissertation, special emphasis is placed on estimating near-surface shear (S)-wave velocities (V_S) which can be used for exploration seismology as well as geotechnical purposes; and even for planetary studies. A frequency-based surface-wave (Rayleigh-wave or ground-roll) inversion method (MASW: Multichannel Analysis of Surface Waves) has been used to estimate 1D and 2D S-wave velocities. The method has been applied on varied seismic datasets related to numerical modeling, physical modeling, and field surveys. The field seismic datasets are from different geological settings and geographical locations: 1) La Marque, Texas, 2) Barringer (Meteor) Crater, Arizona, 3) YBRA field camp, Montana, 4) Hockley fault survey, Texas, and 5) Bradford, Pennsylvania. Estimated S-wave velocities range from as low as 100-300 m/s (La Marque, Hockley) to as high as 3400-3500 m/s (physical model: blank glass block). For the Meteor Crater survey, an unconsolidated near-surface structure (ejecta-blanket) and its thinning thickness trend (thickness decreasing from 20 m to 5 m) has been successfully identified using 2D V_S structure (400-1200 m/s). The depths of investigation for S-wave velocities vary from only 10 m (Hockley survey) to 180 m (Bradford survey) depending on acquisition geometries and source types. Apart from the identification of geological structures; S-wave velocities have been used to calculate S-wave statics and predict densities. The long-wavelength S-wave statics have been calculated for Bradford and Meteor Crater surveys. The densities have been successfully predicted from V_S for modeling experiments and field data (Bradford and YBRA surveys). All predicted densities are consistent with known values with a maximum error of 6%. The effect of lateral heterogeneity on MASW has also been evaluated using different numerical and physical models (dipping layers varying from 10?ð to 90?ð). MASW works well for gentle heterogeneity but provides smeared velocity structures for sharp heterogeneities (physical model experiment and Hockley fault survey). A basic full-waveform inversion scheme has been applied on a numerical model with a vertical interface (i.e. 90?ð dip) showing its potential to handle lateral heterogeneity problems.

Three seismic methods were used to delineate bedrock fracture zones in shallow carbonate rock covered by thin glacial overburden in northwest Ohio. Two study areas were investigated in this thesis: the first area is a parking lot at the Wood County Hospital with two sinkholes exposed to the surface, and the second area is Carter Park, which has been reported to have bedrock fracture zones from previous studies using a variety of geophysical techniques. Data were collected using Multi Channel Analysis of Surface Waves (MASW), seismic refraction with linear and radial geophone arrays. The MASW method was developed based on the dispersion of the seismic energy. This method was used to find lateral variation in shear waves velocities, which can be related to differing degrees of fracturing in the bedrock. The seismic refraction and radial arrays were used as to provide independent evidence for the bedrock fracture zones. In Wood County Hospital site, a single sinkhole was located with using multimode inversion of surface waves, which is more sensitive to the fine structures. In Carter Park, the fracture zones were located by finding shear wave velocity heterogeneities. Two fracture zones were mapped each with a bearing of 030o and were confirmed by using both the linear and radial refraction arrays. These fracture zones correspond to those proposed from earlier studies, thus confirming the utility of using MASW for this type of investigation.

This book gathers the latest advances, innovations, and applications in the field of energy, environmental and construction engineering, as presented by international researchers and engineers at the International Scientific Conference Energy, Environmental and Construction Engineering, held in St. Petersburg, Russia on November 19-20, 2020. It covers highly diverse topics, including BIM; bridges, roads and tunnels; building materials; energy efficient and green buildings; structural mechanics; fluid mechanics; measuring technologies; environmental management; power consumption management; renewable energy; smart cities; and waste management. The contributions, which were selected by means of a rigorous international peer-review process, highlight numerous exciting ideas that will spur novel research directions and foster multidisciplinary collaborations.

Earthquake Geotechnical Engineering for Protection and Development of Environment and Constructions contains invited, keynote and theme lectures and regular papers presented at the 7th International Conference on Earthquake Geotechnical Engineering (Rome, Italy, 17-20 June 2019. The contributions deal with recent developments and advancements as well as case histories, field monitoring, experimental characterization, physical and analytical modelling, and applications related to the variety of environmental phenomena induced by earthquakes in soils and their effects on engineered systems interacting with them. The book is divided in the sections below: Invited papers Keynote papers Theme lectures Special Session on Large Scale Testing Special Session on Liquefact Projects Special Session on Lessons learned from recent earthquakes Special Session on the Central Italy earthquake Regular papers Earthquake Geotechnical Engineering for Protection and Development of Environment and Constructions provides a significant up-to-date collection of recent experiences and developments, and aims at engineers, geologists and seismologists, consultants, public and private contractors, local national and international authorities, and to all those involved in research and practice related to Earthquake Geotechnical Engineering.

Shear waves and closely related interface waves (Rayleigh, Stoneley and Scholte) play an important role in many areas of engineering, geophysics and underwater acoustics. In some cases interest is focused on large-amplitude waves of low frequency such as those associ ated with earthquakes and nuclear explosions; in other cases low amplitude waves, which have often travelled great distances through the sediment, are of interest. Both low and high frequency shear and interface waves are often used for seafloor probing and sediment characterization. As a result of the wide spectrum of different interests, different disciplines have developed lines of research and a literature particularly suited to their own problems. For example water-column acousticians view the seafloor sediment as the lower boundary of their domain and are interested in shear and interface waves in the near bottom sediments mainly from the standpoint of how they influence absorption and reflection at this boundary. On the other hand, geophysicists seeking deep oil deposits are interested in the maximum penetration into the sediments and the tell-tale

characteristics of the seismic waves that have encountered potential oil or gas bearing strata. In another area, geotechnical engineers use shear and interface waves to study soil properties necessary for the design and the siting of seafloor structures.
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