



**1st SMILAB
Research
Conference**

*February, 26-27,
2022*

**Pecos Monastery
Santa Fe, NM, USA**



“Take the best that exists and make it better.”

— Henry Royce

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Keynote Speaker – Dr. Charles Farrar



Charles Farrar (Ph.D. Civil Eng. Univ. of New Mexico) is a Los Alamos National Laboratory (LANL) Fellow and the leader of LANL's Engineering Institute. The first ten years of his career focused on performing experimental and analytical structural dynamics studies for a wide variety of systems including nuclear power plant structures subjected to seismic loading, and weapons components subjected to various portions of their stockpile-to-target loading environments. Since 1992 his research has focused on integrated hardware and software solutions to structural health monitoring problems. This work has been documented in 300+ publications and a book entitled *Structural Health Monitoring: A Machine learning Perspective* (H-index of 58). His work has been recognized through the inaugural Los Alamos Fellows Prize for Technical Leadership, the inaugural Lifetime Achievement Award in Structural Health Monitoring, and election to Fellow in the American Society of Mechanical Engineers, the Engineers Australia Eminent Lecture Tour and a U.K. Royal Academy of Engineers Distinguished Visitor Fellowship. In 2000 he founded the Los Alamos Dynamics Summer School. Working jointly with faculty at the Univ. of California, San Diego (UCSD) he then developed the Engineering Institute. He is a UCSD adjunct faculty member (teaching a graduate course on structural health monitoring), an associate editor for *Earthquake Engineering and Structural Dynamics*, and the developer of a structural health monitoring short course that has been offered 30 times to industry and government agencies in Asia, Australia, Europe, South America, and the U.S.

1st SMILAB Research Conference Schedule

February 26-27, 2022

Saturday, February 26	
7:00	Departure
8:30 – 9:15	Breakfast
9:15 – 9:30	Opening Remarks and Welcome
9:30 – 10:30	Session 1
10:30 – 11:00	Break and photo
11:00 – 12:20	Session 2
12:20 – 12:30	Break
12:30 – 13:30	Lunch
13:30 – 14:50	Session 3
14:50 – 15:05	Coffee Break
15:05 – 16:05	Session 4
16:05 – 16:20	Break
16:20 – 17:20	Keynote Speaker
17:20 – 18:00	Break
18:00 – 19:00	Dinner
19:00 – 21:30	Group Activities
21:30	Adjourn

Sunday, February 27	
7:30 – 8:30	Breakfast
8:30 – 9:30	Keynote Speaker
9:30 – 9:45	Break
9:45 – 10:15	Closure and Final talk
10:15 – 10:30	Break
10:30 – 12:30	Outdoor activities
12:30 – 13:30	Lunch
13:30	Driving back to ABQ

Presentation Schedule

Saturday, February 26		
9:15 – 9:30	Dr. Moreu	Opening remarks
Session 1		
Chair: Xinxing Yuan		
9:30 – 9:50	Mahsa Sanei	Application of RGB camera in structure's inspection
9:50 – 10:10	Eric Robbins	Application of Acceleration Amplitude Control and Voltage Control Tests to Strong and Weak Nonlinear Structures
10:10 – 10:30	Kaveh Malek	Application of AR Headset for Infrastructure's inspection

Session 2		
Chair: Eric Robbins		
11:00 – 11:20	Odey Yousef	Evaluation of event-based camera for structural dynamic measurement and control
11:20 – 11:40	Angela Montoya	Detection of Transient Structural Response with Information Theory
11:40 – 12:00	Xinxing Yuan	Automatic evaluation of bridge rebar placement using LiDAR data
12:00 – 12:20	Elijah Wyckoff	Augmented Reality for interactive robot control and sensor feedback

Session 3		
Chair: Elijah Wyckoff		
13:30 – 13:50	Pratistha Sharma	Modelling of time series chlorophyll-a concentration data using cubic spline method and remote sensing techniques
13:50 – 14:10	Joshua Murillo	Low-cost Efficient Wireless Intelligent Sensors (LEWIS) for Aquatic Sensing
14:10 – 14:30	Ali M.Khorasani	Enhance the steel structural inspection accuracy using Augmented Reality (AR)
14:30 – 14:50	Dilendra Maharjan	Seismic design of special concentrically braced steel frame

Session 4		
Chair: Mahsa Sanei		
15:05 – 15:25	Saiqa Mustari	Implementation of Eye-Gazing feature with Augmented Reality based inspection
15:25 – 15:45	Jackson Kock	Power Scaling of Yb-based Optical Cryo-Coolers
15:45 – 16:05	Alicianna Martinez	Environmental Sensing and Indian Law

Keynote Speaker Presentation Schedule

Saturday, February 26		
16:20 – 17:20	Dr. Chuck Farrar	A Complexity-Based Framework for Structural Health Monitoring
Sunday, February 27		
8:30 – 9:30	Dr. Chuck Farrar	Some Guidelines on Writing a Technical Paper

Presentations' Abstracts

Xinxing Yuan



Title: Automatic evaluation of bridge rebar placement using LiDAR data

Abstract: According to bridge owners, the precise layout of rebar during construction is key to the durability of reinforced concrete structures and has a significant impact on structural strength. A novel rebar recognition algorithm that automates comparison of as-built rebar, as measured by Light Detection and Ranging (LiDAR), to specifications to quantify the accuracy of the rebar layout.

Affiliation: PhD student in Structural Engineering

Ali Khorasani



Title: Enhance the steel structural inspection accuracy using Augmented Reality (AR)

Abstract: In this project, to improve the human perception during steel structural inspection, an augmented reality software was developed. The software helps the inspectors to locate tiny fatigue cracks at the suspicious parts of a steel structure by recording a short video when the structure is under loading. Then the software makes further analysis and projects the crack's hologram laid on the cracked surface in front of the user's eyes.

Affiliation: PhD student in Civil, Construction and Environmental Engineering

Eric Robbins



Title: Application of Acceleration Amplitude Control and Voltage Control Tests to Strong and Weak Nonlinear Structures.

Abstract: This research applies acceleration amplitude control and voltage control tests to a fixture-pylon structure containing a strong nonlinearity and a c-beam structure containing a weak nonlinearity. The shaker-system stability was assessed as different materials and lengths of stingers. Based on preliminary testing, inconsistencies were found between the two structures as the strong nonlinear system continued to demonstrate jumps between stable solutions whereas the weak nonlinear structure demonstrated a multivalued response. The resulting disagreement of results was examined by exploring the stability of each system under the applied test strategy.

Affiliation: PhD student in Structural Engineering

Dilendra Maharjan



Title: Seismic design of special concentrically braced steel frame

Abstract: Steel structures represent majority of modern-day construction. Special Concentric Braced Frames (SCBF) are widely used lateral force resisting system for steel structures because of their ductility and rigidity. This presentation explores the use of SCBF lateral system for the design of a new two-story school building located in Albuquerque, New Mexico. The design is based on AISC standard: Seismic Provisions for Structural Steel Building, AISC 341. The presentation also explores the detailing requirements of SCBF connections to sustain large inelastic deformation and avoid premature failures.

Affiliation: Design Engineer, Heatly Engineering

Mahsa Sanei



Title: Application of RGB camera in structure's inspection

Abstract: Inspection of structure is an important job which is time and labor consuming, it also needs accuracy and considerable amount of money should spend on it. Using RGB camera and creating point cloud data of the structure will help the inspectors to mitigate the human errors, save lots of time and energy, and increase the accuracy of inspection. In this presentation, the potential use of RGB camera will be addressed and some examples will be shown.

Affiliation: PhD student in Structural Engineering

Kaveh Malek



Title: Application of AR Headset for Infrastructure's inspection

Abstract: During the last decade, the infrastructure engineering and construction industries have increased their interest in Augmented Reality (AR). The general transition in AR has moved from research and gaming to industry and business. AR mixes reality and virtual information in the field, which brings new opportunities to infrastructure industry. It is therefore timely to understand what AR is and why AR is here to stay; where and when was designed, developed, and offered at its early days; what are the current efforts in areas related to infrastructure, more specifically in human-infrastructure interfaces; finally, which gaps are being investigated based on the preliminary results.

Affiliation: PhD student in Mechanical Engineering

Pratistha Sharma



Title: Modelling of time series chlorophyll-a concentration data using cubic spline method and remote sensing techniques.

Abstract: The modelling of chlorophyll-a concentration helps to understand harmful effects in marine species caused by increased nutrient loads. To reduce the effect of missing data, this study employed the cubic spline model by using a satellite data for investigating seasonal variations of chlorophyll-a mapped in an 8 day interval consisting of missing values in Pattani Bay, Thailand from the year 2003 to 2017. This study used the spline-fitted data for creating the baseline model of chlorophyll-a in Pattani Bay, and for examining the difference between spline fitted and monthly average data. Comparing two models, the spline-fitted observation yielded a smoother curve pattern than the monthly average. It was also able to display the chlorophyll-a data at any day of the year.

Affiliation: MS in Geography and Environmental Studies

Elijah Wyckoff

Title: Augmented Reality for interactive robot control and sensor feedback



Abstract: Intuition allows human workers to solve tasks faster than robots. When these human capabilities are coupled with the repeatability and endurance of robots, full potential can be realized. Augmented Reality is primarily a visualization tool which also enables a higher level of intuitive control of robots. Building an interface that includes feedback from sensors, robot data, and robot commands condenses pertinent information to reduce the cognitive load of the human and simplify control.

Affiliation: MS student in Mechanical Engineering

2nd Lieutenant Joshua S Murillo



Title: Low-cost Efficient Wireless Intelligent Sensors (LEWIS) for Aquatic Sensing

Abstract: Low-cost sensors have routinely been utilized for methods of monitoring structures, environments, and human activity. However, their implementation for measure water activity, as well as, underwater activity has been limited. This presentation summarizes the design development of aquatic LEWIS sensors and demonstrates field experiments that have been conducted with LEWIS in detecting the two parameters of surface and subsurface activity.

Affiliation: United States Marine Corps, Masters student in Global and National

Alicianna Martinez



Title: Environmental Sensing and Indian Law

Abstract: The implementation of sensors in tribal communities will be a large factor in enhancing the community's resilience. The use of sensors in tribal communities will allow them to monitor environmental conditions. Monitoring environmental conditions and being familiar with them is important for tribal communities and intersects with Indian Law in relation to the development of policies and laws supporting environmental/tribal goals.

Affiliation: 2nd Year Law student at the University of New Mexico School of Law

Odey Yousef



Title: Evaluation of event-based camera for structural dynamic measurement and control

Abstract: Structural dynamic testing experiments typically rely on lab-scale representations of a larger system with contact or optical vibration measurement instruments. The former modifies the behavior of the system and are limited to discrete locations on the structure, and the latter is inefficient in data collection. Neuromorphic event-based cameras offer a solution, asynchronously storing information from pixels in the scene with dynamic behavior. This allows for efficient data collection and real-time processing at orders of magnitude greater efficiency for data storage and processing speed. This work advances previous results by evaluating time delays with a novel event packaging method.

Affiliation: MS student in structural engineering

Saiqa Mustari Susmita



Title: Implementation of Eye-Gazing feature with Augmented Reality based inspection

Abstract: This study introduces application of eye-gazing feature in augmented reality devices to perform structural inspection and assist decision making. This technology will assist inspectors to perform efficiently, reduce human errors during inspection and improve the quality of the inspection.

Affiliation: PhD student in Civil, Construction & Environmental Engineering

Jackson Kock



Title: Power Scaling of Yb-based Optical Cryo-Coolers

Abstract: Optical refrigeration of Yb:YLF is used to cool an arbitrary payload. An astigmatic Herriott cell enhances the total pump laser absorption by keeping the average pump intensity below the saturation while minimizing the leakage from the cavity. A spectrally-selective reflection coating mitigates the effects of amplified spontaneous emission and parasitic lasing, which limit the power scaling for temperatures <140 K.

Affiliation: PhD student in Physics

Angela Montoya



Title: Detection of Transient Structural Response with Information Theory

Abstract: The Information Impulse Function (IIF) is a simple algorithm that displays the temporal character of structural response data. Transient signatures, indicative of shock response, are readily viewable with the IIF even when system is highly nonlinear. A brief overview of the concept behind the IIF is presented. Simulated nonlinear response data is then used to demonstrate the effectiveness the IIF against both running variance and the Holder exponent. The results show an improved ability to detect transient response. SAND2022-1876 A

Affiliation: PhD student in Structural Engineering

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Presentation Review Sheet

Based on the presentations you observed and your conversations with the presenters, please rank in order your three choices for best overall display and discussion:

First:

Second:

Third:



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