

Online Model Based Systems Engineering Bootcamp

Sponsored by the National Science Foundation







The University of Texas RioGrande Valley

College of Engineering & Computer Science

OCTOBER 15 - 16, 2020

Workshop to be conducted via ZOOM



Message from Project Director



It is a pleasure to welcome you all to the Online Model Based Systems Engineering Bootcamp (MBSE) being conducted through The University of Texas Rio Grande Valley. This online bootcamp is sponsored by the National Science Foundation's (NSF) EHR Core Research: Production Engineering Education and Research (ECR: PEER) program, which seeks to improve the education of future and current professionals in production engineering.

The Online MBSE Bootcamp is a two-day workforce development workshop for bringing together experts in MBSE and Production Engineering to discuss the importance of MBSE in industries and academia. We believe that the insights gained from the participants during the scheduled bootcamp activities will contribute to addressing the national need for well-educated engineers and technicians by providing resources and training on model-based systems engineering for production engineering to enhance the capabilities of the Nation's STEM workforce. Further, we strongly believe this effort will enable in strengthening the capacity of The University of Texas Rio Grande Valley in the domain of Systems Engineering contributing to a competitive workforce of underrepresented citizens across all the careers stages in the Rio Grande Valley region impacting the valley's manufacturing, automotive, and production industry.



Message from Project Director (continued)



The University of Texas Rio Grande Valley is a public research university with multiple campuses in the Rio Grande Valley region of Texas with main campuses in Edinburg and Brownsville. UTRGV offers 64 bachelors', 49 master's, and 4 doctoral programs constituting 89.2% Hispanic American student enrollment. As one of the youngest components of the University of Texas System, UTRGV is a minority-serving institution catering mostly to the underrepresented Hispanic demographic of the Lower Rio Grande Valley region. It has one of the highest concentrations of Hispanic students (both in number and percentage) compared to other universities in the nation. Aligned with the core strategic plan of UTRGV, we believe this bootcamp will aid the participants a pathway to impact their careers and will provide opportunity to build a well-prepared workforce of underrepresented Hispanics.

Finally, we would like to thank all the speakers and workshop instructors who are participating in this online event in making it a great success, and NSF in making this event possible. We encourage all the attendees to see this as a networking opportunity and build professional relations, which will stimulate your personal growth, and professional growth.



Dr. Satya Aditya Akundi Assistant Professor, Department of Manufacturing and Industrial Engineering, The University of Texas Rio Grande Valley. Email: satya.akundi@utrgv.edu

AGENDA | THURSDAY

10:00-10:15a*	Opening Presentation Dean of UTRGV
	College of Engineering & Computer Science,
	Dr. Ala Qubbaj

10:15-10:30a Break | Networking

10:30-12:00p Keynote Speaker | Using MBSE to Perform Functional Analysis to Analyze Customer Requirements, Yvonne Bijan, Lockheed Martin Corporation

12:00-1:00p Lunch Break

1:00-2:30p Workshop 1 | Supporting development of complex system through modeling, simulation and MBSE, Dr. Oscar A. Mondragon Campos | Session 1

2:30-3:00p Break | Networking

3:00-4:30p Workshop 1 | Supporting development of complex system through modeling, simulation and MBSE, Dr. Oscar A. Mondragon Campos | Session 2

*All posted times are in Central Standard Time (CST)



AGENDA | FRIDAY

- 9:00-10:00a* Workshop 2 | Simulation in Support of Digital Twins and Industry 4.0, David T. Sturrock | Session 1
- 10:00-10:10a Break | Networking
- 10:10-11:00a Workshop 2 | Introduction to Simio, David T. Sturrock | Session 2
- 11:00-11:10a Break | Networking
- 11:10-12:15pWorkshop 2 | Experimenting to Analyze
Results, David T. Sturrock | Session 3
- 12:15-1:00p Lunch Break
- 1:00-2:00pWorkshop 2 | More on Modelling with Simio,
David T. Sturrock | Session 4
- 2:00-2:10p Break | Networking
- 2:10 -3:00pWorkshop 2 | Process Improvement PrinciplesWorkshop, David T. Sturrock | Session 5
- 3:00-3:10p Zoom Break-out rooms | Debrief and Networking
- 3:10-3:40pWorkshop 2 | Design and Scheduling CaseStudies, David T. Sturrock | Session 6
- 3:40-4:00p Wrap-up and Discussion
- 4:00-4:30p Closing and Remarks



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KEYNOTE SPEAKER





Yvonne Bijan, Ph.D

Technical Fellow Lockheed Martin

Personal Summary

Yvonne Bijan has worked for Lockheed Martin for twenty years and has a Doctor of Philosophy in System Engineering from Southern Methodist University. Dr. Bijan is a Lockheed Martin Fellow and has worked on numerous aeronautics and space programs including F-35 and Space Based Infrared System. She is a Certified Enterprise Architect, Certified Systems Engineering Professional, Certified SysML Model Builder Advanced, SAFe Agilist, and holds a QFD Greenbelt. She has a B.S. in Physics with a minor in Math and an M.S. in Computer Science with a concentration in Software Engineering. Dr. Bijan was the President of the North Texas Chapter of INCOSE for two years and is now the Corporate Advisory Board representative for Lockheed Martin.

Using MBSE to Perform Functional Analysis to Analyze Customer Requirements

The theory of Systems Engineering says we start at the top with customer needs, define requirements for the top-level system in our product hierarchy, then decompose those requirements into the subsystem requirements at the next level down in the hierarchy- or does it? Some believe architecture work can begin once the requirements work is completed at any given level, but is that the only time that the tools and methods for architecture are useful? Have you ever been on a program where the practice of Systems Engineering aligns with the theory of Systems Engineering 100 percent? How do you cope with the deviations from the theory? What happens when the original requirement at the top is not an appropriate one that people should start with?

This presentation will have a brief overview of systems engineering and then walk through an example of a top-level requirement handed down from a customer to a program. We will use functional analysis to improve the requirement and answer the preceding questions.





Oscar A. Mondragon Campos, Ph.D

Clinical Associate The University of Texas at El Paso

Personal Summary

Dr. Oscar A. Mondragon is Director of the Master of Science in Software Engineering and associate professor of practice in the Computer Science Department at the University of Texas at El Paso. From 2014 - 2019, he was Director of the Online MS in Systems Engineering (SE) defining the strategy and managing the development of the new program. Dr. Mondragon is coauthor with Lockheed Martin Aeronautics of the SE Boot Camp; a course offered to college engr. students. He has published papers and journal articles in formal requirements specification formal requirements verification, property specification patterns, requirements modeling, process improvement, CMMI model, INCOSE Handbook, PSP and TSP frameworks, service system models, and managing smart cities application development. Dr. Mondragon has been working as a consultant, guiding companies in the implementation of guality models such as CMMI, PSP, TSP, and AIM. Dr. Mondragon is a certified Introduction to CMMI instructor, CMMI MDDAP Appraisal Team Member, PSP instructor, TSP coach, and INCOSE ASEP, and IEEE senior member and CSDP. Dr. Mondragon facilitates process improvement projects and develops skills in project management, project monitoring, risk management, supplier management, requirements engineering, configuration management, measurement and analysis, process and product quality assurance, verification, validation, process definition, process performance, and quantitative project management. He mentors self-management teams, develops team building skills, develops defect removal skills for individuals and teams, conducts gap analysis, and prepares Engineering Process Groups.



Supporting development of complex system through modeling, simulation and Model Based System Engineering.

There has been an increasing trend in size and complexity of systems making them more difficult to understand, validate, specify their behavior and functionality, create its architecture and design, develop, and verify their defined functionality and behavior. System development based on paper documentation and manual validation & verification is not enough to handle the complexity and tight development schedules. The use of models and simulations throughout the system lifecycle to support systems analysis, verification, and validation has become imperative to build complex systems with quality. Models and simulations provide the means to understand, define, and unambiguously communicate both system requirements and system solution (architecture). Models can be used to provide a visual representation of the problem and/or system solution in artifacts produced in mission analysis, stakeholder requirements, system requirements, architecture, and design. Models have syntax and semantics that facilitate a consistent use of the model, its semi-formal definition, and its interpretation avoiding the ambiguity embedded in natural language.

The workshop covers different types of models and simulations addressing different purposes and needs, type, fidelity, and the complexity of their abstractions and analyses involved. The workshop reviews the characteristics of models and simulations; use of models and simulations to understand different system's aspects; and the use of models to verify systems requirements, validate system artifacts with customer/end user, and determine the affordability to meet performance requirements. In addition, the workshop covers how models and simulations are used to support the entire system life cycle through Model-Based Systems Engineering (MBSE), which is a model-centric approach





David T. Sturrock

Vice President of Products Simio LLC



Personal Summary

David Sturrock is Co-founder and Vice-President of Products for Simio, where he leads product development, training, and simulation services. With over 35 years of experience, he has applied simulation to improve productivity and reduce costs in transportation logistics, manufacturing, scheduling, highspeed processing, business processes, capacity analysis, process design, healthcare, and plant commissioning. He received his bachelor's degree in industrial engineering from The Pennsylvania State University with concentrations in manufacturing and automation and received the 2020 Outstanding ngineering Alumni Award from PSU.

David began his career at Inland Steel Company as a plant industrial engineer. During a time of industry consolidation, he built an innovative simulation/scheduling group to improve company-wide effectiveness and efficiency. This effort was so successful that it was expanded to also assist the steelmaker's suppliers and customers. He subsequently joined Systems Modeling as a development lead for SIMAN and Arena products, then joined Rockwell Automation as the Product Manager for Rockwell's entire suite of simulation and emulation products. David is an active member of the Institute of Industrial and Systems Engineers (IISE), APICS, INFORMS, PDMA, SME, and other professional groups. He is also a co-author of four simulation textbooks and a field faculty at the University of Pittsburgh.



Company Description

Simio is a private company headquartered near Pittsburgh Pennsylvania focused on delivering disruptive solutions that dramatically improve ffectiveness of system design, generate optimal, feasible schedules proven with risk-based analysis, and provide the leading process digital twin solution. Simio was founded by C. Dennis Pegden, Ph.D., widely recognized as a pioneer in simulation, scheduling, and digital transformation.

Many of the same team members who brought you SIMAN, Arena, Tempo, and a long line of industry breakthroughs are now creating the next generation of simulation, scheduling, and digital transformation tools. Find out more at **www.simio.com**

Workshop Overview

Years ago, you would use simulation only for the largest projects – use it once to help evaluate system design, then put it back on the shelf waiting for another big-budget project. Continuous advances in rapid modeling, flexibility, and functionality provide many new opportunities to better design and operate your system in the world of make-to order, the Smart Factory, and Industry 4.0.

Learn how you can optimize your system design, plan the most effective intermediate-term strategy, then use that same tool in combination with your existing data to generate highly productive and feasible schedules. Find out how virtual factory models provided by the latest simulation tools are a key component supporting digital transformation to the Smart Factory of the future.

This workshop will start with an introduction to simulation and Simio, a leading simulation product. Then we will intersperse hands-on training with case study discussions describing how companies have used simulation in visualizing and analyzing systems for improving business operations. We will finish the day exploring the technology and benefits of recent disruptive technologies that are revolutionizing planning and scheduling and providing unique support for digital transformation and digital twins.



Workshop Overview Continued

Session 1 | Simulation in Support of Digital Twins and Industry 4.0/ Introduction to Simulation

Understand the 'Digital Twins' people are talking about. Find out how virtual factory models provided by the latest simulation tools are a key component of the Smart Factory of the future. Then learn the basics of how simulation technology differs from other approaches.

Session 2 | Introduction to Simio*

Learn the basics of Simio while building a simple model. Overview major Simio components and the basics of data handling, randomness, distributions, and expressions.

Session 3 | Experimenting to Analyze Results*

Continue with the previous model to evaluate a small problem, along the way learning about experimentation, replications, and optimization.

Session 4 | More on Modeling with Simio*

Dig deeper into Simio to explore some common objects in the Standard Library for representing machines, transporters and workers.

Session 5 | Process Improvement Principles Workshop*

Reference the included e-book and build models to illustrate some of the process improvement concepts.

Session 6 | Design and Scheduling Case Studies

Discuss how customers have applied simulation to solve a variety of problems.

SPONSORS





We would like to thank the National Science Foundation for sponsoring this Bootcamp.

For more details on the activities of the project "Modelbased Systems Engineering Boot Camp: An Initiative to Integrate Current Systems Engineering Transformations into Workforce Development" - Grant # 1952634, please visit:







Department of Manufacturing & Industrial Engineering







