



THE SOCIETY FOR  
**MODELING & SIMULATION**  
INTERNATIONAL

# International Conference on Bond Graph Modeling and Simulation (ICBGM'21)

**NOVEMBER 8 – 10, 2021**

**Best Western Plus Hacienda Hotel  
Old Town, San Diego, CA**

# General Information

## Conference Program Schedule

Mon. November 8, 2021			La Palma (400 Building)
8:00 a.m.	-	5:00 p.m.	Registration
8:30 a.m.	-	10:00 a.m.	Session 1
10:00 a.m.	-	10:30 a.m.	Morning Coffee Break
10:30 a.m.	-	12:00 p.m.	Session 2
12:00 p.m.	-	1:30 p.m.	Lunch (on your own)
1:30 p.m.	-	3:00 p.m.	Session 3
3:00 p.m.	-	3:30 p.m.	Afternoon Coffee Break
3:30 p.m.	-	5:30 p.m.	Session 4
5:30 p.m.	-	7:00 p.m.	SCS Welcome Reception
Tues. November 9, 2021			La Palma (400 Building)
8:00 a.m.	-	5:00 p.m.	Registration
8:30 am	-	10:00 a.m.	Session 5
10:00 a.m.	-	10:30 p.m.	Morning Coffee Break
10:30 a.m.	-	12:00 p.m.	Session 6
12:00 p.m.	-	1:30 p.m.	Lunch (on your own)
1:30 p.m.	-	3:00 p.m.	Session 7
3:00 p.m.	-	3:30 p.m.	Afternoon Coffee Break
3:30 p.m.	-	5:00 p.m.	Session 8
Wed. November 10, 2021			La Palma (400 Building)
8:00 a.m.	-	12:00 p.m.	Registration
8:30 a.m.	-	10:00 a.m.	Keynote Speaker Plenary Session 9
10:00 a.m.	-	10:30 a.m.	Morning Coffee Break
10:30 a.m.	-	12:00 p.m.	Session 10
3:00 p.m.	-	4:30 p.m.	San Diego Harbor Cruise (Sign Up Required)*

\*Meet up will be at Lobby

# **2021 Bond Graph (ICBGM)**

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Old Town—San Diego  
San Diego, California USA**

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# **Welcome to Bond Graph 2021 (ICBGM)**

## **Welcome from the General Chair and the Program Chair of Bond Graph 2021 (ICBGM'21)**

Dear Conference Participants,

Professor Granda and I welcome you to the 2021 International Conference on Bond Graph Modeling (ICBGM'21). Our conference organizers have struggled with the effects of the world wide pandemic but we anticipate a successful conference in the interesting and beautiful city of San Diego. We have done our best to maintain the tradition of in-person presentations since we feel that personal interactions of an international group of those interested in bond graph modelling is vital to the continuing progress in the field. We are sorry That international travel restrictions may still prevent some people from attending.

We are happy to report that a number of interesting papers will be presented. The papers will be in the areas of bond graph theory, simulation techniques, modeling methods and engineering applications. It will be evident that bond graph techniques are continuing to be developed on a world wide scale and are being applied to an ever widening field of problems.

We hope that your stay in San Diego will be both pleasant and personally productive.

Dean Karnopp and Jose Granda

# **2021 Bond Graph (ICBGM)**

Sponsored by:

The Society for Modeling and Simulation International (SCS)  
American Institute for Aeronautics and Astronautics (AIAA)

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The 14th International Conference on Bond Graph Modeling and Simulation (ICBGM'2021) brings together research paper presentations, panel sessions, tutorials, workshops, seminars, industrial applications, and software demonstrations that use Bond Graph modeling methods. There will be featured plenary speakers and some special invited presentations.

This conference focuses on Bond Graph modeling techniques for modeling and simulation of dynamic systems. Theoretical principles for electrical, mechanical, hydraulic, thermal, pneumatic, control and mechatronic systems applications will be presented. Leading industrial users of the method in automotive, aircraft, fluid power, kinematics, multibody systems, and social and biological systems have been invited.

COVID-19:

In an effort to reduce COVID-19 exposure, you are welcomed to wear a mask and follow COVID-19 safety guidelines on the hotel premises. SCS will provide masks and hand sanitizer that attendees are welcome to use. However, SCS is not responsible for the spread or contraction of COVID-19 during and after the ICBGM'21 event.

# General Information

## **Hotel Check In**

Lobby

Complimentary Parking

Hotel Shuttle to and from the San Diego International Airport is available

Coffee only available from 8:00 a.m.—10:00 a.m.

Hotel Maps Available at Registration Desk

## **ICBGM 2021 Registration**

La Palma Foyer

(In front of the 400 Building)

Sunday, November 7, 2021

3:00 p.m. to 5:00 p.m.

Monday-Tuesday, November 8-9, 2021

8:00 a.m. to 5:00 p.m.

Wednesday, November 10, 2021

8:00 a.m. to 12:00 p.m.

## **ICBGM 2021 Meeting Room**

La Palma

(400 Building)

Monday: 8:30 a.m. to 5:30 p.m.

Tuesday: 8:30 a.m. to 5:00 p.m.

Wednesday: 8:30 a.m. to 12:00 p.m.





# General Information



## **ICBGM 2021 Breaks**

La Palma Foyer  
(In front of the 400 Building)

AM Coffee Break:  
Monday-Wednesday 10:00 a.m. to 10:30 a.m.

PM Coffee Break:  
Monday– Tuesday 3:00 p.m. to 3:30 p.m.

## **ICBGM 2021 SCS Monday Evening Welcome Reception**

Café Coyote Restaurant  
2461 San Diego Ave, San Diego, CA 92110

Monday, November 8, 2021

5:30 p.m.



## **ICBGM 2021 Wednesday Harbor Cruise**

San Diego Harbor  
990 North Harbor Drive  
San Diego, CA 92101

Wednesday, November 10, 2021

3:00 p.m.

*\*Shuttle Provided*

## **ICBGM 2021 WIFI Code**

Hacienda99

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# Keynote

# Keynote

Title: The Role of the Bond Graph Methodology in the Digital Age

Author: Jesus Felez, Ph.D.,  
Polytechnic University of Madrid

Location: La Palma (400 Building)

Date/Time: November 10, 2021  
8:30 a.m. to 10:00 a.m.

**Abstract:** A digital twin is a virtual representation that serves as the real-time digital counterpart of a physical object or process. Though the concept originated earlier (attributed to Michael Grieves, then of the University of Michigan, in 2002) the first practical definition of digital twin originated from NASA in an attempt to improve physical model simulation of spacecraft in 2010. Digital twins are the result of continuous improvement in the creation of product design and engineering activities. Product drawings and engineering specifications progressed from handmade drafting to computer aided drafting/computer aided design to model-based systems engineering.



The digital twin is disrupting the entire product lifecycle management (PLM), from design, to manufacturing to service and operations. Nowadays, PLM is very time-consuming in terms of efficiency, manufacturing, intelligence, service phases and sustainability in product design. A digital twin can merge the product physical and virtual space. The digital twin enables companies to have a digital footprint of all of their products, from design to development and throughout the entire product life cycle.

The automobile industry has been improved by digital twin technology. A specific example of digital twin technology in the automotive industry is where automotive engineers use digital twin technology in combination with the firm's analytical tool in order to analyze how a specific car is driven. In doing so, they can suggest incorporating new features in the car that can reduce car accidents on the road, which was previously not possible in such a short time frame.

On the other hand, in the future, for example, automated vehicles will have to prove for safety assessment and homologation that they can master complex traffic scenarios using sensors and algorithms. To provide this proof poses great challenges for classic test procedures and will lead to numerous virtual tests in simulation. Nevertheless, how can we ensure sufficient trust and validity in the simulation models to pave the way for automated driving?

# Keynote (Continued)

My talk focuses on these problems, dealing the design of methods for modeling, simulate, design and implement advanced control systems in complex dynamic models, including post processing systems that allow the realistic tridimensional visualization of the simulated model, making what is called a virtual prototype. The objective of this talk is think in how to apply these simulation methodologies to vehicles, especially in the new and disruptive transportations systems, like autonomous vehicles or ultra high speed guided vehicles like the Hyperloop.

The development of virtual prototypes requires their geometrical and physical modeling as well as their dynamic behavior. This physical modeling implies the use of several technologies like multiphysics modeling, multi-body systems, and system dynamics and control, with the aim of producing high realistic simulations. I will emphasize the role that the Bond Graph methodology plays in these processes.

**Biography:** Jesus Felez received the Mechanical Engineer and Doctoral degrees from the University of Zaragoza, Spain, in 1985 and 1989, respectively. He became a Full Professor at UPM, Spain, in 1997. He has served as thesis advisor for 30 master's theses and eight doctoral dissertations. He has published 12 books, over 100 technical papers and has been actively involved in over in more than 50 R&D national and international projects with public competitive funding and more than 50 relevant R&D projects with private companies.

Prof. Felez is the expert in the field of railway technology, member of the scientific commission for the railway sector in Spain and head of the Research Group in Simulation in Mechanical Engineering at UPM. His research interests are in the area of modelling and simulation, particularly in bond graph modeling, and its applications of mechatronic systems and vehicular technology. His main research area is the field railway engineering and technologies applied to the future railways, in particular to train control systems.

He has been the head of the Railway technologies Research Group at UPM. The activity of this Research Group can be quantified in more than 20 projects per year, supported by private and public funding with 3 M€ income. His research group has a wide range of successfully experiences in topics as: development of new components, systems and applications in rolling stock, fixed installations, control systems, and learning systems, mainly in the railway sector, but also in the transportation sector in general.

He has also developed research in the field of vehicle dynamics focused on the design and simulation of autonomous vehicles. He developed a complex model for traffic accident analysis. Also a research is addressed to the design of a truck circulating in an e-Highway, with hybrid traction and connected to a catenary when it is in its lane, and with pure electric traction with batteries when it disconnects from the catenary for, for example, overtaking maneuvers. His last research has been addressed to control stability of autonomous articulated vehicles. Prof Felez has also a wide experience in management of Educational and Research institutions. He has been dean of the School of Industrial Engineering at UPM for eight years.







# **Agenda**

# ICBGM Agenda

Monday, 8 November 2021

## Session 1: Bond Graph Theory I

8:30 a.m. – 10:00 a.m.      La Palma      Chair: Dean Karnopp

- *Achieving Desired Modal Damping Ratios in Lumped Segment Continuous System Models* by Geoff Rideout
- *C-Field Representation of Compliance in Lumped-Parameter Finite-Mode Representations of Continuous Systems with Multiple Force Inputs* by Layne Clemen and Donald Margolis
- *Multi-Physics Modelling of Quench in a Superconducting Magnet using Bondgraph* by Sankar Ram Thekkethil, Soumen Kar, and Vikas Rastogi

**10:00 a.m.—10:30 a.m. COFFEE BREAK**

## Session 2: Bond Graph Theory II

10:30 a.m. – 12:00 p.m.      La Palma      Chair: Layne Clemen

- *Bond Graph Modelling and Dynamics of a Power Regenerative Hydrostatic Transmission Dynamometer Approach* by Biswaranjan Mohanty and Kim A. Stelson
- *Increasing Complexity Vehicle Models for Analyzing and Designing Automotive Control Systems* by Gladys Abapo Donovan and Donald Margolis

**12:00 p.m.—1:30 p.m. LUNCH ON YOUR OWN**

## Session 3: Vehicles and Transportation Systems I

1:30 p.m. – 3:00 p.m.      La Palma      Chair: Jose Granda

- *Inertial Force Actuator Applications to Active Vehicle Suspensions* by Jordan McCrone and Donald Margolis
- *Modeling Motion Sickness Using a Four-Wheel Vehicle Model Augmented with a Passenger Model* by Mr. Eunil Kim Ali Akbari, and Donald Margolis
- *Bond Graph Modeling of a Planar Vehicle with Electric Traction Motors for Assisted Torque-Vectoring* by Donghun Lee, Johnathan Loyola, and Donald Margolis

**3:00 p.m.—3:30 p.m. COFFEE BREAK**

## Session 4: Mechanical Systems

3:30 p.m. – 5:30 p.m.      La Palma      Chair: Donald Margolis

- *Calculation Of Torque And Drag In Directional Drilling Using A Multi-Body Bond Graph Approach* by M.K.S. Liyanarachchi, Geoff Rideout, Sampath Liyanarachchi, and Geoff Rideout
- *A Bond Graph Representation of the Sagittal Spine for Estimation of Ride Comfort* by Ali Akbari and Donald Margolis

# ICBGM Agenda

Tuesday, 9 November 2021

## Session 5: Vehicles and Transportation Systems II

8:30 a.m.– 10:00 a.m.

La Palma

Chair: Eilif Pedersen

- *Advanced Steering Stability Controls for Articulated Vehicles by Using Bond Graphs and Model Predictive Control* by Jesus Felez and Alvaro Lopez-Mendez
- *Modeling and Simulation of Heavy Vehicles Air Brakes Applicable Laws of Physics* by Jose Granda

**10:00 a.m.—10:30 a.m. COFFEE BREAK**

## Session 6: Mechanical Systems II

10:30 a.m.– 12:00 p.m.

La Palma

Chair: Johnathan Loyola

- *Fatigue Failure Prognosis of an Oil Well Drill String Using a Lumped Segment Bond Graph Model and Finite Element Method* by Mihiran Galagedarage and Geoff Rideout
- *Bond Graph Model of a Fighter Pilot's Breathing Support System* by Raul Longoria and Mark M. Koeroghiana

**12:00 p.m.—1:30 p.m. LUNCH ON YOUR OWN**

## Session 7: Control Systems and Electronics

1:30 p.m.– 3:00 p.m.

La Palma

Chair: Pushparaj Pathak

- *Modeling Non-Backdriving Behavior in an Electromechanical Steering Actuator Using Bond Graphs* by Jonathan Loyola, Kyungbok Lee, and Donald Margolis
- *Active Vibration Control of Two Flexible Link Underwater Manipulator* by Sunil Kumar, Vikas Rastogi, and Prabhkiran Kaur
- *Bond Graph Modeling of Brake-by-Wire Actuators on a One-Wheel Vehicle Model* by Ehsan Arasteh and Francis Assadian

**3:00 p.m.—3:30 p.m. COFFEE BREAK**

## Session 8: Bond Graph Theory III

3:30 p.m.– 5:00 p.m.

La Palma

Chair: Forbes Brown

- *Comprehensive Dynamic Model of a Cable-Driven Parallel Robot using the Bond Graph Approach* by Ishan Chawla, Pushparaj Mani Pathak, Arun Kumar Samantaray
- *Bond Graph Approach for Modelling of Proton Exchange Membrane Fuel Cell System* by Kamyar Maleki Bagherabadi, Stian Skjong, and Eilif Pedersen

# ICBGM Agenda

Wednesday, 10 November 2021

Keynote Plenary Session 9

8:30 a.m. – 10:00 a.m.

La Palma

Chairs: Dean Karnopp and José J. Granda

Presentation: The Role of the Bond Graph Methodology in the Digital Age

Author: Jesus Felez, Ph.D.

**10:00 a.m.—10:30 a.m. COFFEE BREAK**

Session 10: Multi-Energy Systems

10:30 a.m. – 12:00 p.m.

La Palma

Chair: Jesus Felez

- *Treating Multiphase Channel Flow with THERMOSIM* by Forbes Brown
- *Electric Torque Vectoring Driveline Technology Assessment via Bond Graph Modeling and Simulation* by Jose Velazquez Alcantar, and Ming Kuang
- *Dynamic Linearization of a Synchronous Machine for Control: A Bond Graph Approach* by Raquel S. Rodriguez, Gilberto Gonzalez-Avalos, Noe Barrera Gallegos, Gerardo Ayala Jaimes



# Notes

## Notes

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# The City of Old Town San Diego



# **Things to do in Old Town**

## **Old Town Market San Diego**

4010 Twiggs St., San Diego, CA 92110

+1 619-278-0955

<https://www.oldtownmarketsandiego.com/>

Take a trip back in time to experience the California of the 1850s, when Europeans first made their way to what would become San Diego. Today's Old Town offers unique opportunities for boutique shopping, one-of-a-kind dining, and numerous other must-see points of interest. Make time to explore the Old Town Historic Park, which is an official California Historical Landmark as well as being listed on the National Register of Historic Places.

## **Bazaar Del Mundo**

4133 Taylor St, San Diego, CA 92110

+1 (619) 296 3161

<https://bazaardelmundo.com/bdm/old-town-san-diego/>

When you walk down the street in the bazaar, you are taken to the Old Mexican world with various shops lined along and offering diversified collectibles from around the world. This is a shopping paradise in San Diego. Whatever one would be looking for, you would definitely find it here. With twinkling lights and Mexican vibrant colors around, the shops are packed with exclusive items perfect for creating our memories or to give to our friends and families as a token of our love and remembrance. The shoppers have a variety of choices and shop to choose in Bazaar Del Mundo market. From home accessories or collectibles to fashionable dresses and clothes, shoppers can also choose hand crafted art and crafts. Not only these, the Bazaar Del Mundo has something to offer for everyone, be it colorful tabletop linens or kitchen accessories or cookbooks to the traditional crafts and folk art from Mexico or imported ceramics from around the world. For the jewelry lovers, this place is a Shangri-La for shopping, one can get all sorts of traditional Mexican jewelry like the famous Taxco Sterling silver jewelry or Huichol Beaded jewelry to the ones designed by some famous designers. All the textile and handicrafts available in the shops in the Bazaar are just stunning and the colors and variety of their merchandise makes it a treat.

## **The Whaley House Museum**

1400 Patten Rd., Lookout Mountain, GA 30750

+1 866-820-2531

<https://www.trolleytours.com/san-diego/whaley-house>

Overwhelmingly praised as the first of its kind and the finest home in Southern California, the Whaley House was a central pillar of the 19th Century Old Town community. Besides being the Whaley family home, it was also San Diego's first commercial theater, the county courthouse, and a general store. The legendary Whaley House is widely regarded as one of the most iconic landmarks in San Diego. From its rich Greek Revival architecture style and authentic decor to its mysterious past and unrivaled haunted pedigree, it's no wonder this home attracts visitors from all over the world. Spend the day exploring the family home of Thomas Whaley and be transported back to San Diego life in the 1800s. Grab a memorable souvenir at the Verna House, located directly behind the Whaley House, and stick around for a delicious meal at the New Orleans Creole Cafe. See what makes the famed Whaley House an absolute San Diego must do experience!



# Things to do in Old Town

## **Toby's Candle & Soap Shop**

2645 San Diego Ave, San Diego, CA 92110

+1 619-297-5426

<https://www.tobyscandles.com/>

Make your very own kaleidoscope candle! Whether you are a local, visiting San Diego, or across the country, our candle making kits are available both in store and online. You can choose from a variety of colorfully scented wax cubes to create a unique pillar candle of your own.

## **San Diego Tour: Hop-on Hop-off Trolley**

Old Town Stop: 4010 Twiggs St., San Diego, CA 92110

+1 866-753-8064

<https://www.trolleytours.com/san-diego>

This San Diego hop-on hop-off trolley tour provides an easy and affordable way to get around the city. This tour helps you avoid the hassle of finding and paying for parking. The trolley tour, available as a silver, gold, or platinum pass, allows you to travel your own itinerary at your own pace. Along with 11 stops around the city, it also includes guided commentary and large, open windows. Stop A is located at the entrance to the Historic State Park and Old Town Market, featuring over 40 specialty gift shops.

## **Cousin's Candy Shops**

2711 San Diego Ave, San Diego, CA 92110

+1 619-297-2000

<https://cousinscandyshop.com/>

Judy McCord, the owner of Old Town Cousins Candy Shop began her candy adventures after taking an early retirement as a flight attendant. In 1987, she bought an old fashioned candy shop in a Historic, Tourist town in Montana. Some years later, wanting to expand her candy horizons, she became a concessionaire at Old Town State Historic Park in San Diego, CA. She travelled between the two shops for many years, but recently sold her shop in Montana and focuses all her energies on the Candy Shop in Old Town in San Diego, CA. She believes you can not find a better business to be in. People are always happy buying candy! Every day is a "sweet day"!

## **Mormon Battalion Historic Site**

2510 Juan St, San Diego, CA 92110

+1 619-298-3317

<https://www.churchofjesuschrist.org/learn/historic-sites/california/mormon-battalion-historic-site?lang=eng>

The Mormon Battalion Historic Site is a historic site in Old Town, San Diego, California, in honor of the members of The Church of Jesus Christ of Latter-day Saints who served in the United States Army's Mormon Battalion during the Mexican-American War of 1846-1848.

## **Restaurants in Old Town**

### **El Agave Restaurant & Tequileria**

2304 San Diego Ave B, San Diego, CA 92110-2895

+1 619-220-0692

<https://elagave.com/>

The best place in San Diego to enjoy authentic Mexican Cuisine is El Agave Restaurant and Tequileria, located within our Tequila Museum where you can try over 2000 different tequilas. It is the perfect setting to experience the true flavor of Mexico. If you are looking for a great place for a business lunch, romantic dinner or just to enjoy a fine Tequila with friends or someone special, we are ready to serve you. Do not just go out to an ordinary restaurant, join us for a unique experience.

### **Tequila Factory Restaurant**

2467 Juan Street, San Diego, CA 92110

+1 619-260-8124

<https://oldtowntequilafactory.com/>

The ever popular Old Town Tequila Factory Restaurant and Cantina in San Diego is a charming hillside retreat overlooking historic Old Town San Diego "is a terrific spot to enjoy great Margaritas and delicious Authentic Mexican Food from scratch in San Diego. Freshly made Tortillas and Guacamole, Giant Margaritas, Musical and Breathtaking Views from Old Town to Mission Bay. . . this festive Mexican Restaurant in San Diego has Rooftop Dining and Always FREE Parking!

### **Pizza Bella**

2707 Congress St. San Diego, CA 92110

+1 619-692-4333

<https://www.pizzabellasd.com/>

Pizza Bella Italian Bistro is Old Town's Best Kept Secret. Its award-winning pizza has been recognized as "Best Pizza in America" by many and called "somewhat of a Mecca for serious pizza and pasta aficionados" by The San Diego Union Tribune. Come to Old Town and see for yourself what makes Pizza Bella Italian Bistro one of San Diego's most exciting Italian restaurants.

### **Fiesta de Reyes**

2660 Calhoun Street, San Diego, CA 92110

+1 619-297-3100

<https://www.fiestadereyes.com/>

Whether it's the authentic Mexican food of Casa de Reyes, the bold yet sophisticated fare of Barra Barra or a unique gift for someone special that brings you, we invite you, your friends and your family to experience what Fiesta de Reyes is all about: great food, fantastic atmosphere and an experience to remember.

# **Restaurants in Old Town**

## **Jack & Giulios Italian Restaurant**

2391 San Diego Ave., San Diego, CA 92110

+1 619-294-2074

<https://www.jackandgiulios.com/>

Jack and Giulio's Italian restaurant has remained a favorite of San Diegans for many years. This popular restaurant, formerly known as Giulio's of Pacific Beach, has proudly served the "Best Scampi" since 1961. In addition to this popular dish, this family-owned and operated restaurant offers many homemade pastas, veal, poultry, beef, and seafood specialties.

## **Old Town Mexican Cafe**

2489 San Diego Ave, San Diego, CA 92110-2839

+1 619-297-4330

<https://oldtownmexcafe.com/>

Old Town Mexican café has been a staple in San Diego for more than 40 years. Many people have called their handmade tortillas "the best in the world". Their most popular dishes are Molcajete, Carnitas, ½-roisserie chicken, Pozole, ½ rack of ribs, Guacomole, Carne Asada Dinner.

## **Casa de Freds Tacos y Tequila**

2470 San Diego Ave, San Diego, CA 92110-2883

+1 619-858-8226

<https://fredsoldtown.com/>

Fred's is the place for amigos to have a great time while enjoying quality food, fresh margaritas and a festive atmosphere. They are the only dog-friendly restaurant in Old Town and have a menu designed with your doggies in mind. Both the human and doggie menus offer a wide variety of delicious, Baja-infused selections that are made from fresh, high-quality ingredients. With food and drink specials every single day starting at 3PM, Fred's has plenty of options that will keep your tummies, glasses and pockets full.

## **Harney Sushi**

3964 Harney St, San Diego, CA 92110-2825

+1 619-295-3272

<https://www.harneysushi.com/>

Harney Sushi is San Diego's premier sushi bar and restaurant experience. As fresh and it gets, as imaginative as you want. This is the place where experimentation mixes with celebration, where fine dining service and knowledge fuses with beaming personality and style. Besides having San Diego's only sake bar, Harney boasts more than 40 award winning wines, 30 of the world's best sakes, a private VIP booth and over 30 gourmet specialty rolls named and created by loyalists. Music for your mouth, sushi for your soul. We are proud to offer our Southern California Based, Award-winning, sustainable sushi cuisine since 2001.



THE SOCIETY FOR  
**MODELING & SIMULATION**  
INTERNATIONAL

Serving M&S for Over **60** Years



## WORLDWIDE LEADER IN MODELING & SIMULATION

**Serving individuals and organizations in more than 150 countries.**



For over 60 years, SCS has set the standard as the first society devoted solely to the advancement of modeling and simulation. Our objective is to promote M&S as a discipline and profession through continuous research and education. We provide M&S professionals with a dynamic community and forum to publish, present, and discuss new results, developments, applications, and lessons learned, enabling the exchange between and mutual support of industry, government, and academia.

SCS serves engineers, scientists, managers, educators, business professionals and students from all around the world.

### Opportunities for skill development and advancement include:

#### Membership

Take advantage of networking opportunities, access publications and journals, share your research findings and more.

#### Publications

Get up to date M&S information from our journals.

#### Conferences

Participants may present papers, attend technical sessions, visit exhibit areas, interact with vendors and network with other M&S professionals.

#### Education

SCS strives to help individuals move towards making a transition from a field of Modeling and Simulation to a profession.

\*SCS is a 501(c)3 non-profit organization with four primary business areas: membership, publications, conferences and education.

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