

## Objectives

Soft computing, machine learning and digital twin approaches to science and engineering have become increasingly common. This growing interest is attributed to the advancement of techniques that enable the generation, acquisition and transmission of massive data across disciplines. Machine learning may refer to any technique that gives computers the ability to generate interpretations from data without relying explicitly on rule-based programming. The interest has grown rapidly due to the exponential growth of data, improved facilities such as GPU learning, Tensor Processing Unit, Evolutionary Techniques such as genetic programming, Ensemble Learning such as random decision forests, and more importantly the advancement of deep learning algorithms such as convolutional neural network, and backward propagation algorithms, among many others. To promote the development and application of machine learning and digital twin (MLDT) technologies to the computational science and engineering (CSE) communities, a new series of IACM Special Interest Conferences entitled “Mechanistic Machine Learning And Digital Twins For Computational Science, Engineering & Technology (MMLDT-CSET)” has been planned with the first one to be hosted at San Diego during September 26-29, 2021.

The main objective of MMLDT-CSET is to bring together the diverse communities that are interested in learning, developing and applying machine learning and digital twins via computational science and engineering tools to a broad range of engineering and scientific problems and to promote collaborations between engineers, data and computer scientists, and mathematicians from federal agencies, academia and industry in this field. A concerted effort will be to facilitate participation from engineering firms and computer and software companies to showcase industrial practice and identify challenges and needed MLDT technologies in industry. To promote awareness of machine learning and digital twins to the general public, we will also organize special public lectures, short courses and demonstrations open to STEM high school teachers and students from underprivileged schools in Southern California and other states. A Fellowship Committee consisting of at least five respected scholars with diverse backgrounds will be formed to evaluate fellowship applications, and special emphasis will be placed on diversity and knowledge dissemination.

## Conference Co-Chairs

Wing Kam Liu	Northwestern University
J. S. Chen	UC San Diego
Charbel Farhat	Stanford University
Francisco Chinesta	Arts et Métiers Institute of Technology
George Karniadakis	Brown University
WaiChing Sun	Columbia University

# 1ST IACM CONFERENCE ON MECHANISTIC MACHINE LEARNING AND DIGITAL TWINS FOR COMPUTATIONAL SCIENCE, ENGINEERING & TECHNOLOGY

[mmltdt.eng.ucsd.edu](http://mmltdt.eng.ucsd.edu)

## Date and Location

Sept 26-29, 2021

Hyatt Regency Mission Bay, San Diego, California, USA

## Conference Topics

- Track 1: Multiscale Materials and Engineered Systems
- Track 2: Multi-Modal Generation of Big Data for Machine Learning
- Track 3: Scientific and Engineering Digital Twins
- Track 4: Advanced Manufacturing and Design Optimization
- Track 5: Bio- Systems, Medical Devices, and Mechanistic ML Enhanced Diagnostics
- Track 6: Reduced-order Modeling for Fluids, Solids, and Structures
- Track 7: Injection of Mechanistic ML on Co-Design in High-Performance Computing
- Track 8: Geosystem, Geostatistics, and Petroleum Engineering
- Track 9: Data Centric Earthquake Engineering and Performance-based Design
- Track 10: Infrastructure and Cyberinfrastructure Systems
- Track 11: Technology Transfer for Innovative Scientific and Engineering Applications
- Track 12: Mechanistic ML for the Ecosystem: Environment, Smart City, and Healthcare
- Track 13: Education, Outreach, and Funding Opportunities



## Multi-Institution Organizing Committees

### UC San Diego and Local Organizing Committee

J. S. Chen (Chair)	Structural Engineering, Mech. & Aero. Engineering, CEER
Ken Loh (Co-Chair)	Structural Engineering, CEER, ARMOR Lab
Ilkay Altintas	San Diego Supercomputer Center
Joel Conte	Structural Engineering, NHERI @ UC San Diego
Yuri Fialko	Scripps Institute of Oceanography
Michael Hulst	Mathematics
Rajesh Gupta	Data Science Institute
Boris Kramer	Mechanical & Aerospace Engineering
Andrew B. Kahng	Computer Science and Engineering
Alicia Kim	Structural Engineering, CEER
Shabnam Semnani	Structural Engineering, CEER

### Northwestern University

Jian Cao	Northwestern Institute of Manufacturing Science and Innovation
Wei Chen	Integrated DDesign Automation Laboratory, IDEAL
Wing Kam Liu	Mechanical & Civil Engineering
Matthew Plumlee	Industrial Engineering & Management Sciences
Gregory Wagner	Mechanical Engineering

### Stanford University

Eric Darve	Mechanical Engineering, ICME
Charbel Farhat	Aero. and Astronautics, Mechanical Engineering, ICME
Gianluca Iaccarino	Stanford-KACST Center of Excellence for Aero. and Astro. Mechanical Engineering, ICME

### Arts et Métiers Institute of Technology

Amine Ammar	LAMPA Lab
Ameziane Aoussat	LCPI Lab
Abdel Boudraa	French Naval Academy Research Institute
Laurent Champaney	Arts et Métiers General Director
Francisco Chinesta	Arts et Métiers Institute of Technology
Paola Cinnella	DynFluid Lab
Stephane Clenet	L2EP Lab
Jean-Louis Duval	Arts et Metiers – ESI Chair on Digital Twins
Ivan Jordanoff	Arts et Metiers General Director for Research & I2M Lab
Fodil Meraghni	LEM3 Lab
Lionel Roucoules	LISPEN Lab
Philippe Veron	Carnot Arts Institute

### Columbia University

George Deodatis	Civil Engineering and Engineering Mechanics
Qiang Du	Applied Physics and Applied Mathematics
Jacob Fish	Civil Engineering and Engineering Mechanics
Macro Giometto	Civil Engineering and Engineering Mechanics
Ioannis Kouglioumtzoglou	Civil Engineering and Engineering Mechanics
WaiChing Sun	Civil Engineering and Engineering Mechanics

### Brown University

George Karniadakis	Applied Mathematics
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## International Scientific Committee

### Industry

Prith Banerjee (ANSYS, USA)	Dirk Hartmann (Siemens, USA)
Frederic Barbaresco (Thales, France)	Majid Hojjat (BMW, Germany)
Kevin Carlberg (Facebook, USA)	Samir Khanna (BP, UK)
Sanjay Choudhry (Nvidia, USA)	Uwe Schramm (Altair, USA)
Alain de Rouvray (ESI Group, France)	C. T. Wu (ANSYS, USA)
	Ming Zhou (Altair, USA)

### Federal Government and National Labs

Gabriel Antoniu (INRIA, France)	Grace Peng (National Institutes of Health, USA)
Prasanna Balaprakash (Argonne National Laboratory, USA)	Rekha Rao (Sandia National Laboratories, USA)
Olle Heinonen (Argonne National Laboratory, USA)	Gianluigi Rozza (Scuola Internazionale Superiore di Studi Avanzati, Italy)
Jaroslav Knap (Army Research Laboratory, USA)	Marc Schoenauer (INRIA, France)
Katie Lewis (Lawrence Livermore National Laboratory, USA)	Marius Stan (Argonne National Laboratory, USA)
Frank Liu (Oak Ridge National Laboratory, USA)	James Stewart (Sandia National Laboratories, USA)
Yan Lu (National Institute of Standards and Technology, USA)	Eric J. Tuegel (Air Force Research Laboratory, USA)
John Michopoulos (Naval Research Laboratory, USA)	Paul Witherell (National Institute of Standards and Technology, USA)
Michael Parks (Sandia National Laboratories, USA)	

### Academic

Remi Abgrall (University of Zurich, Switzerland)	Nathan Kutz (University of Washington, USA)
Jose E. Andrade (California Institute of Technology, USA)	Pierre Ladeveze (ENS Paris-Saclay, France)
Raymundo Arroyave (Texas A&M University, USA)	Yvon Maday (UPMC, France)
Yuri Bazilevs (Brown University, USA)	Bernd Markert (Rwth Aachen University, Germany)
Greg Beroza (Stanford University, USA)	Hermann G. Matthies (Technische Universität, Germany)
Markus Buehler (Massachusetts Institute of Technology, USA)	Michael Ortiz (California Institute of Technology, USA)
Jian Cao (Northwestern University, USA)	Stanley Osher (University of California Los Angeles, USA)
David Chen (National Taiwan University, Taiwan)	Paris Perdikaris (University of Pennsylvania, USA)
Wei Chen (Northwestern University, USA)	Stefanie Reese (Rwth Aachen University, Germany)
Didier Clouteau (Ecole Centrale Paris, France)	Stephane Roux (ENS Paris-Saclay, France)
Elias Cueto (Universidad de Zaragoza, Spain)	Lars Ruthotto (Emory University, USA)
Chiara Daraio (California Institute of Technology, USA)	Ruben Sevilla (Swansea University, UK)
Suvranu De (Rensselaer Polytechnic Institute, USA)	Shaoqiang Tang (Peking University, China)
Qiang Du (Columbia University, USA)	Kenjiro Terada (Tohoku University, Japan)
Weinan E (Princeton University, USA)	Michael S. Triantafyllou (Massachusetts Institute of Technology, USA)
Fangxin Fang (Imperial College London, UK)	Nien-Ti Tsou (National Chiao Tung University, Taiwan)
Krishnakumar Garikipati (University of Michigan, USA)	Conrad Tucker (Carnegie Mellon University, USA)
Roger Ghanem (University of Southern California, USA)	Gregory Wagner (Northwestern University, USA)
Dean Ho (National University of Singapore, Singapore)	Wolfgang Wall (TU Munich, Germany)
Antonio Huerta (Polytechnic University of Catalonia, Spain)	Karen Wilcox (University of Texas - Austin, USA)
Surya R. Kalidindi (Georgia Institute of Technology, USA)	Genki Yagawa (University of Tokyo, Japan)
Michael Kaliske (Technische Universität Dresden, Germany)	Wentao Yan (National University of Singapore, Singapore)
Kazuo Kashiwama (Chuo University, Japan)	Masayuki Yano (University of Toronto, Canada)
Benjamin Klusemann (Leuphana University Lüneburg, Germany)	Shinobu Yoshimura (University of Tokyo, Japan)
Dennis Kochmann (ETH Zurich, Switzerland)	Julien Yvonnet (Universite Paris-Est, France)
Ellen Kuhl (Stanford University, USA)	Jessica Zhang (Carnegie Mellon University, USA)

### Location

The conference will take place at Hyatt Regency Mission Bay, San Diego, CA, USA. San Diego is a city on the Pacific coast of California known for its beaches, parks and warm climate. Immense Balboa Park is the site of the renowned San Diego Zoo, as well as numerous art galleries, artist studios, museums and gardens. A deep harbor is home to a large active naval fleet, with the USS Midway, an aircraft-carrier-turned-museum, open to the public.