

附件

第八届中美工程前沿研讨会 (CAFOE) 各子议题内容摘要

➤ Session 1: AI for Transportation

Co-chairs:

Cathy Wu, Assistant Professor, Civil and Environmental Engineering, Massachusetts Institute of Technology

Prof. Xiaolei Ma, School of Transportation Science and Engineering, Beihang University

Session Abstract:

The integration of Artificial Intelligence (AI) into transportation systems has ushered in a new era of mobility, revolutionizing traditional methods and introducing innovative solutions. From the optimization of urban traffic flows to the development of autonomous vehicles, AI has become an indispensable tool in addressing the challenges and harnessing the opportunities in the transportation sector. Recognizing the transformative potential of AI, strategic plans have been initiated to advance AI-driven transportation solutions and promote their widespread adoption across various industries.

Initially perceived as a tool for data analysis and prediction, AI has rapidly evolved to play a pivotal role in real-world transportation applications. Today, AI-driven solutions are at the forefront of addressing critical transportation challenges, from ensuring safety of autonomous vehicles to optimizing global logistics networks. The omnipresence of AI in transportation is evident, influencing every facet, from micro-level route optimizations to macro-level infrastructure planning. This session delves into the profound impact of AI on transportation, exploring its current applications and envisioning its future trajectory.

Key areas of discussion include but are not limited to:

- Autonomous mobility (including on land, water, and air);

- Shared mobility modeling;
- Transportation infrastructure resilience;
- Electrification, energy efficiency, and demand management in transportation;
- Mobility as a service;
- Traffic safety;
- Air traffic management;
- Traffic control systems;
- Logistics and freight transportation optimization;
- Policy and economics for emerging technology in transportation.

Speakers from the U.S. and China will offer their insights and expertise on the aforementioned topics. The objectives of this session are threefold: (1) to showcase cutting-edge research and applications of AI in transportation from both nations, (2) to highlight the challenges, opportunities, and future prospects of AI-driven transportation solutions, and (3) to inspire collaborative endeavors and innovative thinking among the attendees.

➤ **Session 2: Energy Transitions and Challenges**

Co-chairs:

Joe F. Bozeman III, Ph.D., CEM (Assistant Professor, Civil and Environmental Engineering | Public Policy, Georgia Institute of Technology)

Hao Hu, Ph.D. (Deputy Director General, International Standardization, Chinese Society for Electrical Engineering)

Session Abstract:

The world is grappling with the responsibility and challenge of transitioning its energy disposition toward a de-carbonized future. A multitude of challenges remain to be comprehensively addressed given the evolution and emergence of energy technology, associated systems, and programming. These challenges include tech-centric energy transformation to socio-technical matters.

Energy transitions refer to nations, regions, and/or locales that are attempting to move their energy sector toward zero-carbon energy sources and away from fossil fuels. These transitions can be initiated or catalyzed by community-based pressures, matters of national security, climate change concerns, and economic trends as well as other geopolitical factors. These aforementioned factors have several underlying challenges associated. Reducing land, water, and greenhouse gas emissions are climate and environmental change challenges often associated with a de-carbonized energy transition. In the case of community-based pressures, an equitable and just energy transition is an established challenge and includes implications for how and where new energy technologies are deployed, where ecological impacts occur, and how adverse human health effects are distributed. The energy transition economy — such as profits and investments related to coal power plant decommissioning, hydrogen power sources, solar power proliferation, nuclear energy, wind energy, and electric vehicle adoption — has important implications for national security and geopolitics.

Alongside these energy transition challenges, there are a multitude of technological innovation opportunities. The sub-forum titled *Energy Transitions and Challenges* in the upcoming 2024 CAFOE provides an essential platform for identifying critical and emerging high-tech trends. It enables stakeholders to exchange knowledge and explore necessary actions to mitigate climate threats. In focusing on key technologies, the forum highlights important crosscutting objectives, which serve as the foundation for potential solutions to the pressing issue of climate change.

Session topics include but are not limited to:

- Energy transition
 - Next generation power system based primarily on renewable energies
 - Energy storages
 - Renewable energy equipment recycling

- Nanotechnology in energy
 - Nanotechnology for sustainable energy
 - Nanotechnology in energy and health
 - Nanotechnology applications in batteries
- Marine renewable energy
 - Ecological implications of marine renewable energy
 - Marine renewable energy potential: A global perspective

Are there ways that the United States and China can effectively help the world transition in energy? What innovations can we synergize and share for the betterment of all? These are the types of questions that inspire this session. Join us as we grapple with this duality while charting a path toward an energy transition that addresses its many challenges.

➤ **Session 3: Nanotechnology for Health**

Co-chairs:

Zeinab Jahed (University of California San Diego)

Dan Wang (Beijing University of Chemical Technology)

Session Abstract:

Nanotechnology, the manipulation of matter on an atomic or molecular scale, has emerged as a powerful tool in the healthcare sector, opening new frontiers in diagnosis, treatment, and prevention of diseases. Intimately linked with disciplines like biomedical, chemical, electrical, mechanical and optical engineering, nanotechnology offers unparalleled opportunities to revolutionize healthcare by making treatments more effective and diagnostics more precise.

One of the most notable applications of nanotechnology in healthcare is in targeted drug delivery. Nanoparticles, engineered for targeted drug delivery, promise a new era of precision in therapeutics. By directing drugs specifically to the site of disease, these

nanoparticles minimize the exposure of healthy tissues to potent drugs. This is especially transformative in cancer therapy, where nanoparticle-based drug delivery systems can precisely target tumor cells, reducing the dosage required and thereby decreasing the detrimental impacts on the patient's overall health.

Moreover, nanotechnology provides tools to create controlled release drug systems, ensuring that therapeutics are delivered at the right dose and time frame. This can be achieved by designing nanoparticles that respond to specific triggers, such as changes in pH or temperature, or the presence of certain enzymes. As a result, medications can be released on-demand, in response to the unique needs of the patient's body.

Our session will include three major topics:

1. Targeted Drug Delivery Using Nanoparticles:

- Mechanisms of cellular uptake and nanoparticle trafficking within cells.
- Design strategies for targeting specific tissues, cells, or intracellular compartments.
- Overcoming biological barriers (e.g., the blood-brain barrier) with nanoparticles.
- Process intensified synthesis of nanocarriers toward large-scale production.

2. Safety, Efficacy, and Biocompatibility of Nanodrug Systems:

- Assessment of the long-term stability and degradation of nanodrugs in physiological conditions.
- Evaluating the potential toxicity, immunogenicity, and side effects of nanoparticle formulations.
- Strategies for enhancing the biocompatibility of nanodrug systems.
- Current regulatory guidelines and challenges in translating nanodrugs from the lab to the clinic.

3. Advancements in Controlled Release and Responsive Nanodrug Systems:

- Exploration of stimuli-responsive nanoparticles that release drugs in response to specific triggers (e.g., pH, temperature, enzymatic activity).

- The role of materials science in developing novel polymers and materials for controlled release.
- Innovations in multi-drug delivery systems and combination therapies using nanoparticles.

We are pleased to have a mixture of academic and industry speakers who will not only each highlight the state of the art in key nanotechnology for health, but also present a broader perspective on future research challenges of nanotechnology for health and how they are being addressed in commercialized products.

➤ **Session 4: Ocean Engineering-A Sustainable Ocean Future**

Co-chairs:

Dr. Kakani Katija, Monterey Bay Aquarium Research Institute

Prof. Zhen Gao, Shanghai Jiao Tong University

Session Abstract:

With a growing population, there is an expanding need for resources - energy, materials, and food - to sustain this global development. Although the ocean has traditionally served in this capacity through oil and gas exploration, shipping, and fishery, new approaches such as ocean renewable energy utilization, deep sea mining, carbon dioxide removal, aquaculture, and marine biomaterials will greatly expand our interactions with the ocean. These activities, collectively called the Blue Economy, are worth an estimated \$3-6 trillion globally¹, and some of them are important pathways for decarbonization of energy sources.

However, there are calls to temper the growth of the Blue Economy due to concerns around its sustainability. The UN's Sustainable Development Goal number 14 for Life

¹ UNCTAD's Trade and Environment Review 2023:

<https://unctad.org/news/global-blue-deal-urgently-needed-protect-and-invest-our-ocean>

below Water² urges actions to safeguard the ocean, especially in a time where the ocean is undergoing rapid change. Anthropogenic activities linked to coastal eutrophication, climate change (e.g., ocean acidification, ocean warming, and oxygen depletion), plastic pollution, and overfishing are having significant impacts on ocean biological communities, and this coupled with the expanding Blue Economy activities has members of the marine science community concerned. Some of this uneasiness is linked to our current lack of capacity to adequately monitor and better understand the biological communities and the ecosystem in the ocean, and to do so at spatiotemporal scales that capture ocean change.

This session will explore the technologies that are emerging to achieve the balance between the acquisition and use of ocean resources and minimization of their impact on marine biological communities. The speakers from the US and China will explore the following themes from these two perspectives that when combined, can move us towards a sustainable ocean future.

1. Observations and monitoring for better understanding the ocean and the effects of anthropogenic activities:
 - Ocean biological monitoring and automation based on environmental DNA (or eDNA), acoustics, and imaging approaches.
 - Scalable observations for understanding the ocean ecosystem.
 - Modelling and observations of the ocean's physical and biogeochemical environments.

2. Sustainable use of the ocean space and resources:
 - Technologies for cost-effective utilization of ocean renewable energy, including offshore wind, waves, and currents.
 - Decarbonization of the shipping industry by use of low- or zero-emission fuels (e.g., methanol, ammonia, hydrogen).

² UN's Sustainable Development Goals: <https://sdgs.un.org/goals>

- Sustainable development of offshore aquaculture and fishery.
- Environmentally friendly approaches for deep sea mining, carbon capture and storage, and carbon dioxide removal.