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June 20-25, Rhodes, Greece

**The Thirty-first (2021) International
Ocean and Polar
Engineering Conference**

(International Offshore and Polar Engineering Conference)

Including *additional* ISOPE symposia:

*Hydrodynamics & CFD
Comparative Study, CCP, MMS, SPH
Coastal Engineering & CFD
Offshore Mechanics, Ocean Technology
Clean Energy Tech: Ocean, Wind
4th Advanced Ship Technology
6th Underwater Technology
10th Tsunami & Safety
12th Arctic Science & Technology
12th Renewable Energy & Environment
13th Sloshing Dynamics & Design
16th Deep Ocean Mining & Gas Hydrates*

ISOPE-2021

Rhodes, Greece, June 20-25

Updated Technical Program

(zoom time to be updated)

Refereed papers from 40+ countries in 123 technical sessions
1 Plenary and 2 Keynote and multiple Focus sessions
Full Program with General Information, Advance Registration and
Venue Hotel. Paper List, Reservations, and Updates at
<http://www.isopec.org/conferences-symposia-and-workshops/>

ISOPE-2021 Conference proceedings

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Organized and Sponsored by: Technical Program Committee,
International Society of Ocean and Polar Engineers (ISOPE), with
cooperating organizations (listed inside)



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Opening session at ISOPE-2012 Rhodes



ISOPE-2021 Conference Co-chairs

Jin S Chung (USA); Ronald Knapp (USA); Demos Angelides (Greece); Sa Young Hong (Korea), Hiroyasu Kawai (Japan); Hua Liu & Decheng Wan (China)



Chung Knapp Angelides Hong Kawai Liu Wan

**ISOPE-2021 Rhodes:
Hybrid (Live / Online Video)
The 31st Annual ISOPE-2021 Conference,
Rhodes, June 20-25, 2021**

*Expanded Session List and Full Program (digital)
with Paper List: Download from www.isopec.org or
<http://www.isopec.org/conferences-symposia-and-workshops/>*

Full Program (Session and Paper List) and Update:
<http://www.isopec.org/conferences-symposia-and-workshops/>;
Questions to meetings@isopec.org

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Back to In-person Conference: ISOPE-2022
*The 32nd Annual International Ocean and Polar (Arctic)
Engineering Conference, Shanghai, June 6-10, 2022*

Welcome to the ISOPE-2021 Rhodes Conference

We greatly appreciate the excellent response and help, despite the Covid-19 pandemic in 2020, we have received from colleagues around the world in the successful organization of the Hybrid 31st International Ocean and Polar (Arctic) Engineering Conference (**ISOPE-2021**) Rhodes, Greece, June 20-25, 2021. The Conference features **123** sessions of peer-reviewed papers and 3 plenary and keynote presentations from more than **40** countries, including the ISOPE specialty symposia as a part of the ISOPE-2021 Conference.

The conference program is in Live as well as video presentations and discussions.

The purposes of the ISOPE conference are to:

- * Promote technological progress and activities, international technological transfer and cooperation, and opportunities for engineers to maintain and improve technical competence; and
- * Provide a timely international forum for technical activities, cooperation, opportunity and fellowship among researchers and engineers by developing focused session topics with high-quality papers (in both originality and significance) accepted through rigorous review, establishing high international standards for publication and worldwide distribution, and promoting interdisciplinary interaction between academia and industry.

Since 1990, the International Society of Ocean and Polar Engineers (ISOPE) has held 64 successful international meetings with all peer-reviewed papers:

- Annual **ISOPE** conferences, starting in Edinburgh, 1991, have been held around the world in San Francisco, Singapore, Osaka, The Hague, Los Angeles, Honolulu, Montréal, Brest, Seattle, Stavanger, Kitakyushu, Honolulu, Toulon, Seoul, Lisbon, Vancouver, Beijing, Maui (Hawaii), Rhodes, Anchorage, Busan, Kona (Hawaii), Sapporo, and Shanghai (hybrid). Since 1992, the annual ISOPE conference program has been the world's largest of its kind with peer-reviewed papers.
- Pacific/Asia Offshore Mechanics Symposium (**PACOMS**), beginning with the 1st PACOMS-90 Seoul in 1990; also in Beijing, Busan, Daejeon, Vladivostok, Dalian, Bangkok, Shanghai, Gold Coast, Jeju Island, and Dalian, 2020.
- European Offshore Mechanics Symposium (**EUROMS**), starting with the 1st EUROMS-90 Trondheim in 1990; also EUROMS-99 Moscow, EUROMS-2012 Istanbul.
- ISOPE (Deep) Ocean Mining & Gas Hydrates Symposium: Started with 1st **OMS-95/OMGH**, Tsukuba, 1995; followed by Seoul, Goa, Szczecin, Changsha, Lisbon, Chennai, Kona Hawaii, Sapporo, Honolulu, and Shanghai (hybrid), 2020.
- International Deep-Ocean Technology (**IDOT**): Started with IDOT-96 Symposium and Workshop, Los Angeles, 1996; also Stavanger, 2001; Beijing, 2009.
- ISOPE **HPM** (High-Performance Materials) Symposium: Started in Honolulu, 2003 and expanded every year with emerging topics.
- A series of ISOPE specialty symposia: **ANGT**; **SBD**; Nanotechnology **NANOS**; Frontier Energy; Sloshing & Dynamics; Renewable Energy/Environment; Tsunami; Arctic Sci & Tech; Arctic Materials; Asset Integrity; High-Mn/Cryogenic Materials; Materials Reliability, EAC.

On behalf of the Technical Program Committee, it is our pleasure to welcome participants from all over the world to the ISOPE-2021 (hybrid) Conference in Rhodes, Greece.

ISOPE-2022 Shanghai is back to "In-person."

Jin S Chung
USA
Sa Y Hong
Korea

Ronald H Knapp
USA
H Kawai
Japan

Demos Angelides
Greece
H Liu & DC Wan
China

PRESENTATION LIST BY TOPICS

Plenary: 2011 Tsunami in Japan

Ten-year-long Progress from the 2011 Great East Japan Earthquake in Tsunami Monitoring and Coastal Defense in Japan

Hiroyasu Kawai, Port and Airport Research Institute, Japan

Keynote 1: Pacific Ferromanganese Crusts: ROV Exploration

Geological Parameters Controlling the Variability in Grade and Abundance of the Ferromanganese Crusts in the NW Pacific Seamounts: A Review of ROV Exploration and Geochemical Characterization

Akira Usui, Anna Nagaokaka, Kochi University; Kazuhiko Suzuki, JAMSTEC, Japan

Keynote 2: Pacific Ferromanganese Nodules: Mining Vehicle Control

Deep-Ocean Manganese Nodule Miners and Collectors on 18,000-ft Seafloor: Full-scale Miner Touchdown and Automatic Track-keeping Control

Jin S Chung, ISOPE and formerly Lockheed Missiles & Space Co. – Ocean Mining Program, USA

ZOOM PRESENTATIONS

OPENING SESSION, SUNDAY June 20

(to be updated on www.isopec.org)

Conference Opening

Welcome to Rhodes Virtual, 2021

President's Message

Invitation to ISOPE-2022 (In-person) Conference, Shanghai

Virtual Coffee Break in preparation

Monday **CCP-WSI (on Zoom)** Presentations to be updated

CCP-WSI Showcase 1 (on Zoom): Monday (Volume III)

Start Time: 19:00PM (Beijing), 12:00PM (UK, BST), 4:00AM (California)

Chair: Ling Qian, Manchester Metropolitan University, UK
Co-Chair: Edward Ransley, University of Plymouth, UK

CCP-WSI Showcase 2 (on Zoom): Monday (Volume III)

Start Time: 21:00PM (Beijing), 2:00PM (UK, BST), 6:00AM (California)

Chair: Deborah Greaves, University of Plymouth, UK
Co-Chair: Lee Margetts, University of Manchester, UK

Tuesday MMS (on Zoom) Presentations to be updated

Multi-Scale Hybrid Modelling 1 (on Zoom)

Start Time: 19:00 PM (Beijing), 12:00 PM (UK, BST),
4:00 AM (California)

Chair: Zihua Xie, University of Cardiff, UK
Co-Chair: Shiqiang Yan, City University, London, UK

Multi-Scale Hybrid Modelling 2 (on Zoom)

Chair: Qingwei Ma, City University, London, UK
Co-Chair: V. Sriram, IIT Madras, India

Panel Discussion (30 min on Zoom)

Wednesday PARTICLE METHODS (on Zoom) Presentations

Tentative time: 8:00 – 10:05 GMT (To be updated)

Chair: Abbas Khayyer, Kyoto University, Japan
Co-Chair: Shiqiang Yan, City University, London, UK

PANEL DISCUSSION

State-of-the-art of SPH for Ocean/Coastal Engineering

16th OCEAN MINING AND GAS HYDRATES SYMPOSIUM

OMGH I: Gas Hydrates 1

OMGH II: Gas Hydrates 2

**DEEP OCEAN MINERALS:
Exploration and Mining Technology**

Keynote 1

**Geological Parameters Controlling the Variability in Grade and
Abundance of the Ferromanganese Crusts in the NW Pacific
Seamounts: A Review of ROV Exploration and Geochemical
Characterization**

Akira Usui, Anna Nagaokaka, Kochi University; Kazuhiko Suzuki,
JAMSTEC, Japan

OMGH III: Deepsea Exploration

Keynote 2

Deep-Ocean Manganese Nodule Miners and Collectors on 18,000-ft Seafloor: Full-scale Miner Touchdown and Automatic Track-keeping Control

Jin S Chung, ISOPE, Formerly Lockheed Missiles & Space Co. – Ocean Mining Program, Mountain View, California, USA

OMGH IV: Manganese Nodules & Crusts Miner Collector

OMGH V: Deepsea Drilling

OMGH VI: Panel Discussion

**RENEWABLE ENERGY:
OFFSHORE WIND AND OCEAN**

Wind Turbine I

Wind Turbine II: Aero-Hydrodynamics

Wind Turbine III

Wind Turbine IV

Wind Turbine V: Wind Farm

Wind Turbine VI:

Wind Turbine VII: Floating 1

Wind Turbine VIII: Floating 2

Wind Turbine IX: Floating 3

Wave Energy

Ocean & Wave Energy

Tidal Energy

Ocean, OTEC & Solar Technology

OCEAN & WIND Energy: Panel

OCEAN TECHNOLOGY

OCEAN TECHNOLOGY I: Floating Tunnel, Bridge

OCEAN TECHNOLOGY II: Floating System - Floatover

OCEAN TECHNOLOGY III: TLP

FLOATING SYSTEM

Floating System 1

Floating System 2

Floating System 3

ENVIRONMENT AND ECOLOGY

Environment and Ecology 1

Environment and Ecology 2

GEOTECHNOLOGY

GEOTECH I: Soil Properties

GEOTECH II: Piles and Anchors 1

GEOTECH III: Piles and Anchors 2

GEOTECH IV: Foundation, Stability

GEOTECH V: Spudcan

SUBSEA, PIPELINES, RISERS AND UMBILICALS

SUBSEA: South China Sea

PIPELINES & RISERS I: Flow Assurance 1

PIPELINES & RISERS II: Flow Assurance 2

PIPELINES & RISERS III: Pipeline 1

PIPELINES & RISERS IV: Pipeline 2

PIPELINES & RISERS V: Pipeline 3

PIPELINES & RISERS VI: Riser

PIPELINES & RISERS VII: Flexible and Umbilical

PIPELINES & RISERS VIII: Installation

PIPELINES & RISERS IX: Transportation

PIPELINES & RISERS X: Panel

UNDERWATER TECHNOLOGY

UNDERWATER TECH I: Sensing, Communication

UNDERWATER TECH II: Navigation, Path Planning

UNDERWATER TECH III: Control

UNDERWATER TECH IV: Operation

UNDERWATER TECH V: Design, Application

UNDERWATER TECH VI: Hydrodynamics, CFD

UNDERWATER TECH VII: Panel

ARCTIC SCIENCE & TECHNOLOGY

ARCTIC & POLAR I: Ice Loads on Structures

ARCTIC & POLAR II: Ships in Ice and Vessel Design 1

ARCTIC & POLAR III: Ships in Ice and Vessel Design 2

ARCTIC & POLAR IV: Ice Ridges and Ice Properties

ARCTIC & POLAR V: Arctic Regions

ARCTIC & POLAR VI: Iceberg Towing

ARCTIC & POLAR VII: Numerical Simulations

ARCTIC & POLAR VIII: Ships Maneuvering and Icebreaking

ARCTIC IX: Panel

HYDRODYNAMICS

HYDRODYNAMICS I: Sea State

HYDRODYNAMICS II: Wave Loads 1

HYDRODYNAMICS III: Wave Loads 2

HYDRODYNAMICS IV: Wave Characteristics 1

HYDRODYNAMICS V: Wave Characteristics 2

HYDRODYNAMICS VI: Ship Motion 1

HYDRODYNAMICS VII: Ship Motion 2

HYDRODYNAMICS VIII: Wave Impact, Slamming 1

HYDRODYNAMICS IX: Wave Impact, Slamming 2

HYDRODYNAMICS X: Ship Waves

HYDRODYNAMICS XI: Resistance and Bubble Drag 1

HYDRODYNAMICS XII: Resistance and Bubble Drag 2

TSUNAMI

PLENARY ON TSUNAMI

**Ten-year-long Progress from the 2011 Great East Japan Earthquake in
Tsunami Monitoring and Coastal Defense in Japan**

Hiroyasu Kawai, Port and Airport Research Institute, Japan

TSUNAMI AND SAFETY I: Generation

TSUNAMI AND SAFETY II: Disaster and Mitigation

TSUNAMI AND SAFETY III:

SLOSHING DYNAMICS

SLOSHING I: Rocket, SPH

SLOSHING II: Impact

SLOSHING III: Baffles

VORTEX SHEDDING & VIV

Vortex Shedding & VIV 1

Vortex Shedding & VIV 2

Vortex Shedding & VIV 3

COASTAL HYDRODYNAMICS

COASTAL HYDRODYNAMICS I: Wave Mechanics 1

COASTAL HYDRODYNAMICS II: Wave Mechanics 2

COASTAL HYDRODYNAMICS III: Wave Mechanics 3

COASTAL HYDRODYNAMICS IV: Storm Surge

**COASTAL HYDRODYNAMICS V:
Sediment Transport & Nature-based Solutions 1**

**COASTAL HYDRODYNAMICS VI:
Sediment Transport & Nature-based Solutions 2**

**COASTAL HYDRODYNAMICS VII:
Coastal Structures 1**

**COASTAL HYDRODYNAMICS VIII:
Coastal Structures 2**

COASTAL HYDRODYNAMICS IX: Ships & Ports

COASTAL HYDRODYNAMICS X: Panel

HIGH PERFORMANCE MATERIALS

HPM I: Damage Mechanism Affecting HPM

HPM II: Advances in Welding Techniques

HPM III: Failure Analysis of HPM

HPM IV : Advances in HPM

HPM V: Panel

MECHANICS, RISK AND ANALYSIS

Mechanics and Analysis 1

Mechanics and Analysis 2

Mechanics and Analysis 3

ADVANCED SHIP TECHNOLOGY

ADVANCED SHIP I: Bow Wave & Resistance

ADVANCED SHIP II: Cavitation

ADVANCED SHIP III: CFD

ADVANCED SHIP IV: Design

ADVANCED SHIP V: Energy Saving Device

ADVANCED SHIP VI: High Speed Vehicles

ADVANCED SHIP VII: Maneuvering

ADVANCED SHIP VIII: Motion

ADVANCED SHIP IX: Optimization & Stability

ADVANCED SHIP X: Performance in Waves

ADVANCED SHIP XI: Power & Propeller

ADVANCED SHIP XII: Ship Design

ADVANCED SHIP XIII: Strength

ADVANCED SHIP XIV: Waterjet & Pumpjet

ADVANCED SHIP TECH XV: Panel

TECHNICAL PROGRAM

ISOPE–2021 Conference
The 31st Annual ISOPE–2021 Conference, Rhodes, Greece
June 20-25, 2021
Hybrid (Live and Virtual)



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ISOPE Journals and Conference Proceedings:
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Full Program (digital) and Updates include:

2021 Technical Program Committee (TPC) List Proceedings USB
and online

General Information

Information on Entry Visa (NA for 2021): See General
Information

Hotel reservation (NA for 2021) : Online reservation only from
February to secure a room at ISOPE rates.

Conference Registration form from www.isopec.org .

Advance Registration and Hotels: Also inside this program:
<http://www.isopec.org/conferences-symposia-and-workshops/>

See General Information for tours.

ISOPE Publication Order Form

<http://www.isopec.org/> > Publications > Orders

Author Index and Subject Index in Proceedings: Use “Search” from the
PDF file of the Conference program and of the Conference proceedings on
<http://www.isopec.org/proceedings/> [To be posted by early June.]
Those who registered receive the entire proceedings with peer-
reviewed papers in early June]

Photos: The 30th Annual ISOPE Conference (virtual)

Forthcoming ISOPE In-Person Meetings

15th ISOPE PACOMS-2022 (Pacific Asia Offshore Mechanics
Symposium), TBA, September 2022

32nd Annual ISOPE-2022 Conference, Shanghai, China, June 6-
10, 2022

<http://www.isopec.org/conferences-symposia-and-workshops/>.

Delayed celebration of the 30th ISOPE Anniversary at ISOPE-
2022 Shanghai