

清華

2021

NUCLEAR ENGINEERING SUMMER SCHOOL



KAIST



August 2-5, 2021

National Tsing Hua University
Hsinchu, Taiwan

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INTRODUCTION



The Nuclear Engineering Summer School is organized by National Tsing Hua University (NTHU), Shanghai Jiaotong University (SJTU), Korea Advanced Institute of Science and Technology (KAIST) and Kyushu University(KU). This program is hosted in turn by the four universities. There will be 8~12 students and 2~3 professors from each school to take part in this program. The summer school aims at enhancing students' abilities including the nuclear engineering expertise, English communication and global perspective. It is also intended for friendship linkage among students and young researchers in Asian countries.

Since the 1st SJTU-KASIT-NTHU Joint Summer School on Nuclear Science and Technology was held at Shanghai in 2007, the following summer schools have been held annually at Daejeon (2008), Hsinchu (2009), Shanghai (2010), Daejeon (2011), Hsinchu (2012), Shanghai (2013), Daejeon (2014), Hsinchu (2015), Shanghai (2016), Daejeon (2017), Fukuoka (2019), and Shanghai (2020), respectively. This special event has become an important platform for scientific exchange and cultural activity among all participating universities.

The 14th Nuclear Engineering Summer School is held on August 2nd - 5th, 2021 by National Tsing Hua University, Hsinchu, Taiwan. There will be 8 students from KAIST, 7 students from SJTU, 12 students from KU, and 14 students from NTHU this year. Course activities include lectures given by the academic professors and site experts, discussions, presentations. Due to the impact of the COVID-19 pandemic, the 14th joint Summer School will be organized via video conference. We hope this special organization will bring new ideas and new momentum for scientific and cultural exchanges among all participants.

The host wants to express their sincere gratitude to the speakers, members and the committee of the 2021 Nuclear Engineering Summer School, named and unnamed, who has contributed to the success of this summer school.

Schedule

*UTC+09 is a time offset that adds 9 hours to Coordinated Universal Time (UTC)

AUGUST 2ND, MON.

UTC+09

8:40 - 9:00 **Opening**

9:00-9:50 **Lecture 1 : Prof. Chih-Hao Lee (NTHU 1)**

"The applications of synchrotron radiation characterization for radwaste materials"

9:50 - 10:00 **Break**

10:00 - 10:50 **Lecture 2 : Prof. Chai Xiang (SJTU 1)**

"Design and Analysis of Innovative Small Nuclear Reactor"

10:50 - 11:00 **Break**

11:00 - 11:50 **Lecture 3 : Prof. Wei Liu (KU 1)**

"Boiling and CHF under Forced Convection Condition"

11:50 - 13:30 **Lunch**

13:30 - 15:50 **Group discussion**

16:00 - 17:00 **Group Presentations** (each group: 5 mins +Q/A)

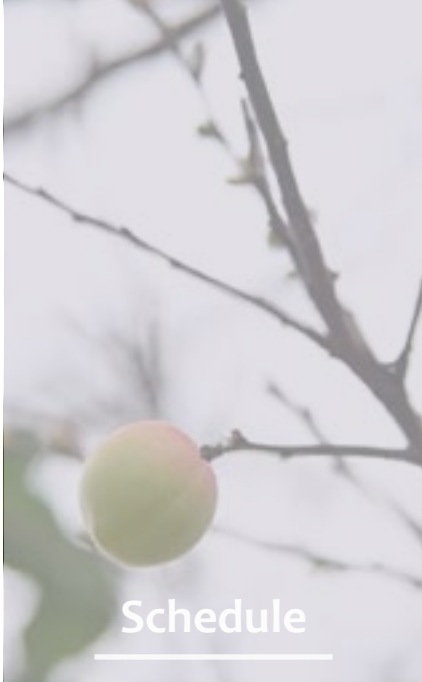


<https://supr.link/yBwBU>

The link will be provided by the corresponding members of each group.



<https://supr.link/YZiMA>



AUGUST 3RD, TUE.

UTC+09

9:00-9:50 **Lecture 4 : Prof. Donghao He (SJTU 2)**
“Review of the combined fission matrix neutron transport method”

9:50 - 10:00 **Break**

10:00 - 10: 50 **Lecture 5 : Prof. Yonghee Kim (KAIS 1)**
“Research Activities for Soluble-Boron-Free & Autonomous SMR”

10: 50 - 11: 00 **Break**

11: 00 - 11: 50 **Lecture 6 : Prof. Tsung-Kuang Yeh (NTHU 2)**
“Water Chemistry and Corrosion in Pressurized Water Reactors”

11: 50 - 13: 30 **Lunch**

13: 30 - 15:50 **Group discussion**

The link will be provided by the corresponding members of each group.

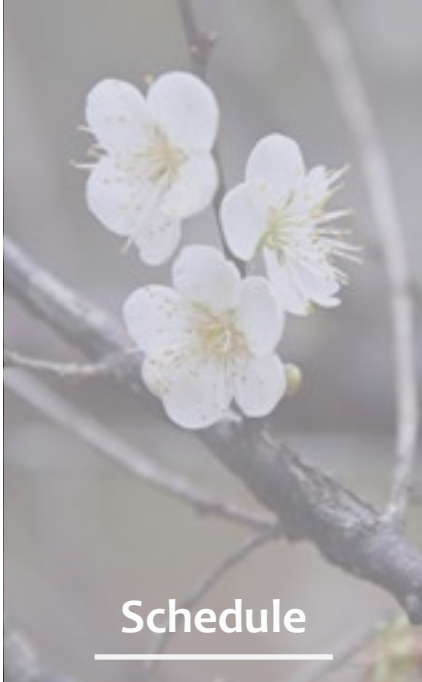
16:00 - 17:00 **Group Presentations** (each group: 5 mins +Q/A)



<https://supr.link/8ufwC>



<https://supr.link/xA4ro>



Schedule

AUGUST 4TH, WED.

UTC+09

9:00-9:50 **Lecture 7 : Prof. Koji Morita (KU 2)**

"A first course of Nuclear Safety"

9:50 - 10:00 **Break**

10:00 - 10: 50 **Lecture 8 : Prof. Hui-Yu Tsai (NTHU 3)**

"Radiation Protection and Safety in Medicine"

10: 50 - 11: 00 **Break**

11: 00 - 11: 50 **Lecture 9 : Prof. Ming-Wei Lin (NTHU4)**

"Measurement of fast neutron spectra based on time-of-flight and deconvolution techniques with organic scintillators"

11: 50 - 13: 30 **Lunch**

13: 30 - 15:50 **Group discussion**

The link will be provided by the corresponding members of each group.

16:00 - 17:00 **Group Presentations** (each group: 5 mins +Q/A)



<https://supr.link/GupZJ>



Schedule

AUGUST 5TH, THR.

UTC+09

9:00-9:50 **Lecture 10 : Prof. Ho Jin Ryu (KAIST 2)**

“Nuclear Fuel Technologies”

9:50 - 10:00 **Break**

10:00 - 10:50 **Lecture 11 : Prof. HE Hui (SJTU 3)**

“Liquid film thickness of annular two-phase flow for different geometries”

10:50 - 11:00 **Break**

11:00 - 11:50 **Lecture 12 : Prof. Kuan-Che Lan (NTHU 5)**

“Biaxial creep performance of CWSR Zircaloy-4 cladding at emulated off-normal conditions of interim dry storage facility”

11:50 - 13:30 **Lunch**

13:30 - 14:20 **Group discussion**

The link will be provided by the corresponding members of each group.

14:30 - 17:00 **Final Presentations** (each group : 10 mins +Q/A)
Evaluations & Concluding Remarks



<https://supr.link/H9gnq>



<https://supr.link/bxmPl>

INSTITUTE OF NUCLEAR ENGINEERING AND SCIENCE

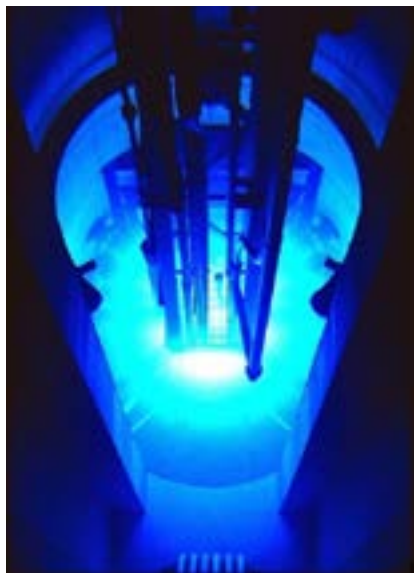
The Institute of Nuclear Engineering and Science at National Tsing Hua University was reestablished in 2007 to undertake the duty of teaching the young generation to become professional nuclear engineers and scientists. The faculty in the Institute have various professional specialties in nuclear engineering and science, and can provide complete and good-quality education in nuclear engineering.

Due to the impacts of energy shortage and global warming, every country in the world is facing the pressure of reducing the emission of greenhouse gases. Therefore, nuclear power will play a very important role in the coming twenty to thirty years before economical renewable energies become available. However, nuclear engineering and science has gone through a low status for the past twenty years, resulting in a shortage of the successors in this field. The Institute was reestablished in time to prevent the situation from getting worse. Besides training young generations, it will also take part in providing correct nuclear energy related information to the decision makers, and publicizing the common knowledge of nuclear energy.

The enrollment of the master program of the Institute started in fall 2007, and the PhD program started in fall 2008. The curriculum can be subdivided into “reactor physics and engineering”, “reactor safety and heat transfer”, “nuclear materials”, “radiation shielding and application”, and “nuclear science and application”.

The research development is consistent with the course categories, and is focused on “nuclear power plant engineering” and “nuclear science and radiation application”.

The Institute provides a variety of courses related to nuclear science and engineering and attracts many well qualified students to enroll. The teaching and research activities of the faculties are highly recognized by the students.



CV of Members and Invited Speakers

HONORARY CHAIR: PROF. MIN LEE



Personal Information

Name: Min Lee

Address: National Tsing Hua University, Department of Engineering and System Science, 101, Section 2, Kung Fu Road, Hsinchu, Taiwan 30043, Republic of China.

TEL: 886-3-5715131 ext. 34316

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Website: <http://www.ess.nthu.edu.tw/p/406-1351-27357,r2082.php?Lang=en>

Education

9/81-8/85 **Massachusetts Institute of Technology** Cambridge, MA, U.S.A.
Department of Nuclear Engineering
Doctor of Philosophy in Nuclear Engineering, May 1985
Thesis Title: “ Modeling of Corium/Concrete Interaction”
Major in Reactor Engineering; Minor in M.I.S.

9/73-6/79 **National Tsing Hua University** Hsinchu, Taiwan, R.O.C.
Department of Nuclear Engineering
Master of Science in Nuclear Engineering, June 1979
Thesis Title: “LOCA Analysis of PWR with RELAP4/Mod5”
Bachelor of Science in Nuclear Engineering, June 1977

Positions Held

2/1989-Present National Tsing Hua University, Hsinchu, Taiwan, R.O.C
Distinguished Professor, Department of Engineering and System Science (8/2012-Present)
Dean of Nuclear Science College (2/2018-Present)

Administrative Positions Held

Vice President / Secretary General (2/2014-7/2017)
Vice President of Genral Affairs (8/2011-1/2014)
Chief Executive Officer, Tsing Hua College (8/2010-2/2014)
Dean of General Affairs, Office of General Affairs (8/2005-7/2006)
Acting Director, Environment Health and Safety Center, Office of General Affairs (8/2005-7/2006)
Dean of Student Affairs, Office of Student Affairs (3/2002-7/2005)
Associate Dean of Student Affairs, Office of Student Affairs (7/1999-3/2002)
Director, Division of Extra-Curricular Activity, Office of Student Affairs (2/1998-3/2003)

Department of Engineering and System Science

Chairman (2/2007 ~ 1/2010)
Professor (8/93 ~ 7/2012)
Associate Professor (2/89 ~ 7/93)



CV of Members and Invited Speakers

PROF. MIN LEE

Honors and Awards

University Outstanding Teaching Award, 1994

University Outstanding Teaching Award, 2000

University Outstanding Teaching Award, 2012

Honorary Teaching Award, NTHU, 2012

University Outstanding Mentor Award, 2009

University Outstanding Award for the Achievement of Cooperation with Industry, 2011

Research Interests

Probabilistic Risk Assessment; LWR Severe Accident Phenomenology; Two Phase Flow and Boiling Heat Transfer; Thermal-Hydraulic Responses of LWR; PSA of Nuclear Power Plant



CV of Members and Invited Speakers

HONORARY CHAIR: PROF. XU CHENG



Personal Information

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Website: www.iatf.kit.edu

Education

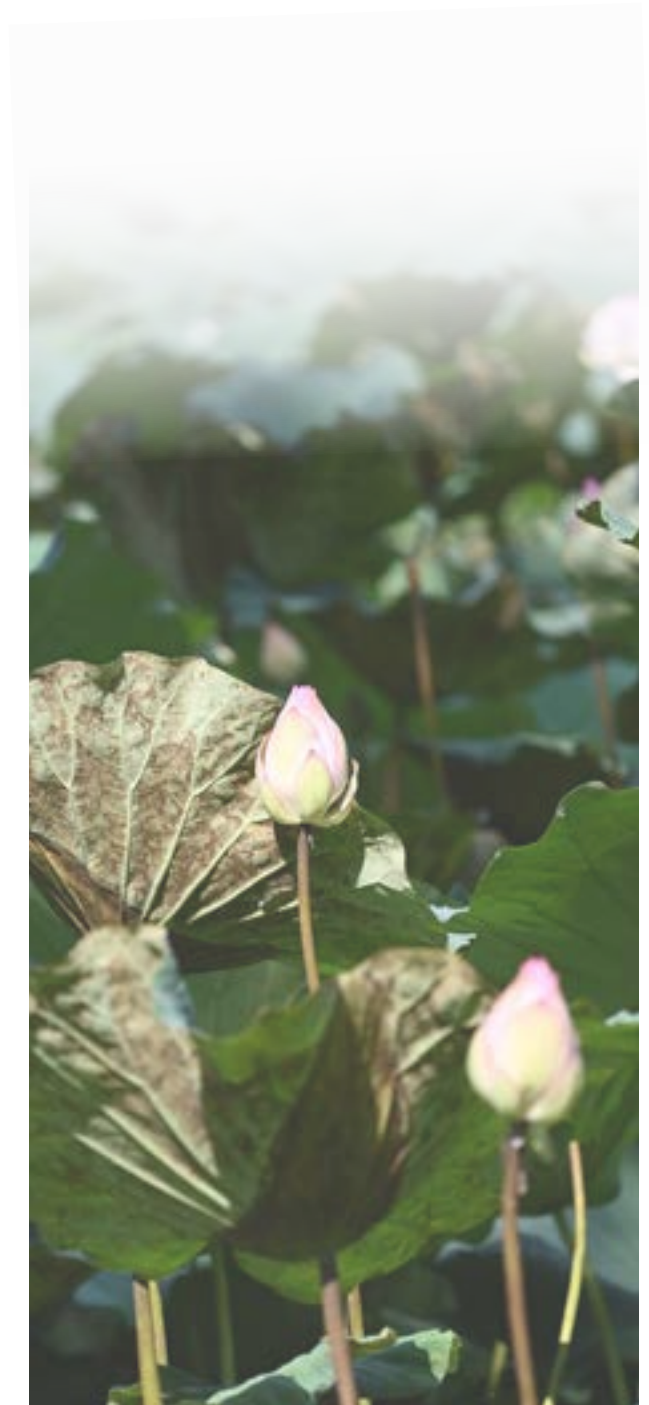
- 1982 B.Sc., Nuclear Engineering at Xi'an Jiao Tong University in China
- 1986 Dipl.-Ing. Mechanical Engineering at the Technical University Braunschweig in Germany
- 1991 Ph.D, Mechanical Engineering at the Technical University Braunschweig in Germany

Positions Held

- Professor, Karlsruhe Institute of Technology (KIT)
- Director of the Institute of Applied Thermofluidics (IATF)
- Chair of the Professorship of Innovative Nuclear System

Research Interests

Nuclear thermal-hydraulics, nuclear safety, advanced nuclear systems



CV of Members and Invited Speakers

ORGANIZER: PROF. AND DIRECTOR RONG-JIUN SHEU



Personal Information

Name: Rong-Jiun Sheu (許榮鈞)

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Email: rjsheu@mx.nthu.edu.tw

Education

1997-2002, Ph.D. Department of Engineering and System Science, NTHU

1991-1993, MSc. Institute of Nuclear Engineering, NTHU

1987-1991, BS. Department of Nuclear Engineering, NTHU

Positions Held

- 2016/08-Present, Director, Institute of Nuclear Engineering and Science, NTHU
- 2015/08-Present, Professor, Institute of Nuclear Engineering and Science & Department of Engineering and System Science, NTHU
- 2011/02-2015/07, Associate Professor, Institute of Nuclear Engineering and Science & Department of Engineering and System Science, NTHU
- 2007/01-2011/01, Project Lead, Radiation Safety System of Taiwan Photon Source, National Synchrotron Radiation Research Center
- 2006/01-2007/07, Division Head, Radiation and Operation Safety Division, National Synchrotron Radiation Research Center
- 2005/01-2011/01, Associate Scientist, National Synchrotron Radiation Research Center
- 1993/07-2004/12, Assistant Scientist, National Synchrotron Radiation Research Center

Honors and Awards

- 2020, Outstanding teaching award, College of Nuclear Science, NTHU
- 2020, Outstanding faculty and research staff, NTHU
- 2019, Outstanding research award, Mutual Fund of MOST and AEC
- 2019, Outstanding faculty and research staff, NTHU
- 2018, Outstanding faculty and research staff, NTHU
- 2016, Outstanding teaching award, College of Nuclear Science, NTHU
- 2015, Outstanding faculty and research staff, NTHU
- 2015, Outstanding student mentor award, College of Nuclear Science, NTHU
- 2014, Award for outstanding R&D contribution, Fuel Cycle and Materials Administration of Atomic Energy Council
- 2012, Outstanding teaching award, College of Nuclear Science, NTHU

Research Interests

Health physics; Reactor physics; Medical Physics

CV of Members and Invited Speakers

PROF. CHIH-HAO LEE (LECTURE 1)



Personal Information

Name: Chih-Hao Lee

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National Tsing Hua University, Hsinchu, Taiwan 30013

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Education

1981-1987, Ph.D. in Nuclear Engineering, National Tsing Hua University, Taiwan.

1977-1979, M.S. in Nuclear Engineering, National Tsing Hua University, Taiwan.

1973-1977, B.S. in Nuclear Engineering, National Tsing Hua University, Taiwan.

Positions Held

Current position

- Professor: Department of Engineering and System Science, National Tsing Hua University.
- Affiliated Professor, Institute of Nuclear Engineering and Science, National Tsing Hua University

Past Position

- 2002-2007, Director, Nuclear Science and Technology Development Center, National Tsing Hua University, Hsinchu. Taiwan.
- 1997-2002, Division Head, Nuclear Reactor Division, Nuclear Science and Technology Development Center, National Tsing Hua University, Hsinchu, Taiwan.
- 1995-2000, Associate Professor, Department of Engineering and System Science, National Tsing Hua University.
- 1987-1995, Research Assistant, Assistant Researcher, Associate Researcher, National Synchrotron Radiation Research Center, Taiwan.
- 1988-1990, Postdoc, Exxon Research and Engineering Company and Brookhaven National Lab. USA
- 1984-1985, Visiting Scientist, Lawrence Berkeley Lab. USA

Honors and Awards

199 SCI journal papers published

Research Interests

Synchrotron radiation and neutron beam applications; Ultra-thin film and surface science; Radiation detection and measurement; Condensed matter physics and chemistry; renewable energy materials

PROF. CHIH-HAO LEE

Lecture Topic & Abstract

The applications of synchrotron radiation characterization for radwaste materials

Synchrotron is a large accelerator with the charged particle moving close to light speed. A high intensity and well collimated synchrotron radiation is emitted with continuous spectra when the orbit of high speed charged particles are bent either by dipolar magnetic or insert devices. Synchrotron Radiation X-rays with techniques such as X-ray absorption spectroscopy, high resolution X-ray diffraction and scattering, and X-ray submicro-meter image methods are useful for characterization of the radioactive waste. Three examples are presented for each technique here. Using the X-ray absorption, the Cs and U absorption sites and local structure in the interlayer of Bentonite which is one of the buffer layer for long term radwaste storage are determined, so that the bonding strength to retard the radioactive ions can be understood. High resolution in-situ X-ray diffraction to study the Montmorillonite structure change especially the lattice spacing of layer structure under different PH values and ion absorption and temperatures. It is an important information for absorption of radioactive ions also. The application of X-ray micro-spectroscopy and tomography technique is to understand the porosity of the structure of graphite, so that the surface area can be determined. In a irradiated graphite of a nuclear plant, the amount of surface absorbed nitrogen become ^{14}C after long time reactor operation. It is an important data for a disposal plan during the de-commissioning of a retired graphite research reactor.



CV of Members and Invited Speakers

PROF. CHAI XIANG (LECTURE 2/COMMITTEE)



Personal Information

Name: Chai Xiang

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Shanghai 200240 China

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Education

2004-2011, Shanghai Jiaotong University, Bachelor, Master.

2011-2014, Karlsruhe Institute of Technology, Doctor.

Positions Held

Associate Professor

Honors and Awards

Sponsored by Shanghai Rising-Star Program

Research Interests

Nuclear Thermal Hydraulics and Safety Analysis, Innovative nuclear design, Multi-physics coupling

Lecture Topic & Abstract

Design and Analysis of Innovative Small Nuclear Reactor

To address the energy needs of remote communities and special purpose, different designs of Small Nuclear Reactor have been proposed over the world. To achieve a long operation without refueling, issues are related to core design using low enriched fuel under specific operational condition such as higher operational temperature and increased leakage due to small core. Various micro-reactors are under development based on highly innovative gas-cooled or heat-pipe concepts in SJTU. Many works have been carried on micro-reactor design, analyses and modeling which aims at addressing the challenges and gaps in terms of modeling and simulation for micro-reactors. High-fidelity multi-physics simulations were demonstrated on micro-reactor concepts by coupling neutronics, thermo-mechanical and heat conduction. This lecture involves detailed neutronic and thermal-hydraulic analyses performed using high-fidelity codes, and developing innovative solutions to enhance the core performance.

CV of Members and Invited Speakers

PROF. WEI LIU (LECTURE 3/COMMITTEE)



Personal Information

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Website: <http://www.qpn.kyushu-u.ac.jp/en/index.html>

Education

Doctor of Engineering, The University of Tsukuba, Mar. 2000

Positions Held

Associate Professor at Kyushu University, Japan

Research Interests

Boiling, CHF and Nuclear Thermal-Hydraulics

Lecture Topic & Abstract

Boiling and CHF under Forced Convection Condition

Boiling heat transfer and CHF under forced convection is very important for reactor systems. In this lecture, students will learn basic boiling processes and CHF mechanisms under forced convection condition.

CV of Members and Invited Speakers

PROF. DONGHAO HE

(LECTURE 4)



Personal Information

Name: Donghao He

Address: Dongchuan Rd 800, Minhang district, Shanghai, China

Email: donghaohe@sjtu.edu.cn

Education

2015.8 – 2020.5, Pennsylvania State University, University Park, PA, Ph.D. in Nuclear Engineering.

2011.9 – 2015.6, Shanghai Jiaotong University, Shanghai, China, B.S. in Physics.

Positions Held

Assistant professor in Shanghai Jiaotong University

Honors and Awards

Shanghai Science of Foundation Yangfan award

Research Interests

Radiation transport, Reactor physics, Monte Carlo neutron transport method

Lecture Topic & Abstract

Review of the combined fission matrix neutron transport method

The fission matrix combined method is a newly developed hybrid neutron transport method. It features a high-fidelity and efficient reactor core physics calculation. This paper will review the main theories employed in the combined fission matrix method, including: the fission matrix “end” combination principle, 2D/1D fission matrix homogenization theory, the fission matrix correction ratio method. The combined fission matrix method has been validated against the Monte Carlo reference calculations in BEAVRS PWR benchmark, experimental reactor, and space reactor. The comparison between the combined fission matrix method and the Monte Carlo method in the BEAVRS steady state low power condition will be presented. The combined fission matrix method reports a 25 pcm k_{eff} error and a 0.52% root mean square error in the pin-wise fission rate calculation. In addition, the combined fission matrix completes the whole core calculation within minutes. Overall, the combined fission matrix method reports a high fidelity and efficiency in a whole-core transport calculation.

CV of Members and Invited Speakers



PROF. YONGHEE KIM (LECTURE 5)

Personal Information

Name: Yonghee KIM

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Education

Ph.D from KAIST in 1995

Positions Held

Professor, Department of Nuclear & Quantum Engineering, KAIST

Honors and Awards

Academic Achievement Award' of Korean Nuclear Society in October, 2017

Research Interests

Reactor Physics, Advanced Reactors, Nuclear Transmutation

Lecture Topic & Abstract

Research Activities for Soluble-Boron-Free & Autonomous SMR

An advanced 450 MWth autonomous water-cooled SMR (small modular reactor) is under development at KAIST in Korea. The SMR is named ATOM (Autonomous Transportable On-demand Reactor module). Main goal of the autonomous SMR is to enhance its the operational safety by eliminating possible human being's mistakes during the plant operation. Also autonomous operation of SMRs can truly minimize the size of personnel for the system operation, and improving the system economy. Top priority of the SMR design is to secure a passive safety, i.e., elimination of the Fukushima-like accident from the system. To achieve the targeted passive safety, the reactor power is set to 450 MWth for the ATOM system. In the autonomous SMR, the system operation is governed by an extremely reliable AI (Artificial Intelligence) using all possible measurement signals. The AI system of the ATOM system, GAIA (Genuinely Autonomous Intelligence for ATOM), is supposed to do multiple functions including control, monitoring, diagnosis, emergency responses, and communication with supervisors. The GAIA system is under development using advanced neural networks such as LSTM and various big-data technologies are being developed in parallel. The GAIA neural networks are trained by using numerous sets of data obtained by a high-fidelity simulator of the ATOM system. Unlike the conventional SMRs, a soluble-boron-free (SBF) reactor is pursued to optimize the inherent reactor safety and maximize reliability of the autonomous ATOM operation. The load-follow operation can be done without any 'active' reactivity control in the reactor, thereby 100% reliable autonomous load-follow operation is guaranteed in the ATOM system. For the SBF ATOM core, innovative burnable absorbers and truly optimized fuel concept are developed to achieve a high performance ATOM core. In addition, a unique ATF (accident tolerant fuel) cladding technology is also introduced to enhance the integrity of the nuclear fuel. In this presentation, the overview of the ATOM system will be discussed and the main design features including the SBF core design will be provided. And the GAIA system will be introduced in detail. In addition, a video clip on the autonomous operation of ATOM will be shared.

CV of Members and Invited Speakers

PROF. TSUNG-KUANG YEH

(LECTURE 6)



Personal Information

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Website: <http://www.ess.nthu.edu.tw/p/406-1351-53426,r2082.php?Lang=en>

Education

Ph. D.	Nuclear Engineering – The Pennsylvania State University, U.S.A.	1992 – 1994
M. S.	Nuclear Engineering – The Pennsylvania State University, U.S.A.	1989 – 1992
B. S.	Nuclear Engineering – National Tsing-Hua University, Taiwan	1983 – 1987

Positions Held

- (1) **Director**, Aug/2015 – present
Nuclear Science and Technology Development Center, National Tsing-Hua University, Taiwan
- (2) **Professor**, Jun/2012 – present
Department of Engineering & System Science, National Tsing-Hua University, Taiwan
- (3) **Acting Dean**, Jul/2017 – January/2018
College of Nuclear Science, National Tsing-Hua University, Taiwan
- (4) **Associate Dean**, Aug/2016 – Jun/2017
College of Nuclear Science, National Tsing-Hua University, Taiwan
- (5) **Chairman**, Feb/2013 – Jan/2016
Department of Engineering & System Science, National Tsing-Hua University, Taiwan
- (6) **Associate Professor**, Aug/2009 – May/2012
Department of Engineering & System Science, National Tsing-Hua University, Taiwan
- (7) **Associate Professor**, Aug/2008 – Jul/2009
Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taiwan

Honors and Awards

- (1) Best Research Project Award, Atomic Energy Council and Ministry of Science and Technology, 2017
- (2) Best Teaching Award, National Tsing Hua University, 2016.
- (3) Best Research Project Award, Atomic Energy Council and Ministry of Science and Technology, 2016
- (4) Academic Excellence Award, National Tsing Hua University, 2011-2016.
- (5) Academic Research Publication Award, National Tsing Hua University, 2011.
- (6) Best Paper Award, The 6th Hydrogen Energy and Fuel Cells Conference, 2011.
- (7) Best Poster Award, IUMRS-ICA 12th International Conference in Asia, 2011.

PROF. TSUNG-KUANG YEH

Research Interests

Nuclear Materials, Reactor Water Chemistry, Corrosion Engineering, Electrochemistry, Fuel Cells, Fracture Mechanics

Lecture Topic & Abstract

Water Chemistry and Corrosion in Pressurized Water Reactors

In light water reactors (LWRs), water is circulated through the reactor core, as a moderator and a coolant. It is the water chemistry of the coolant that dominates the structural integrity of an LWR. From the perspective of a comprehensive and proactive design, an appropriate control over the water chemistry of the coolant in an LWR is essential. For mitigating IGSCC in LWRs, hydrogen and other reducing agents are added into the reactor coolant for maintaining a reducing environment in an LWR. In a pressurized water reactor (PWR), the reactor coolant system consists of a primary coolant circuit and a secondary coolant circuit. The coolants in these two circuits bear distinctly different compositions. However, components in these two circuits suffer from corrosion problems to various extents at different locations. In this class, we will discuss the relationship between water chemistry and materials corrosion in PWRs, and the solutions to these corrosion problems will be presented as well.



CV of Members and Invited Speakers

PROF. KOJI MORITA (LECTURE 7)



Personal Information

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Website: <http://www.qpn.kyushu-u.ac.jp/en/index.html>

Education

Doctor of Engineering, Kyushu University, Jun. 1998

Positions Held

Professor at Kyushu University, Japan

Honors and Awards

Best paper award, The 12th International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Operations and Safety (NUTHOS-12), Oct. 2018.

Research Interests

Nuclear thermal-hydraulics and safety

Lecture Topic & Abstract

A first course of Nuclear Safety

The utilization of nuclear energy is based on the premise that the safety of nuclear reactor facilities is sufficiently ensured. In this lecture, students will learn how safety is ensured in nuclear power plants. In addition, the basic concept of safety assurance, engineering safety features, severe accidents, and safety regulations after the Fukushima accident will be discussed.

CV of Members and Invited Speakers

PROF. TATSUYA MATSUMOTO



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Education

1994 B. Mechanical Engineering at Kyushu University in Japan

1996 M. Interdisciplinary Graduate School of Engineering Sciences at Kyushu University in Japan

2000 Ph.D. Interdisciplinary Graduate School of Engineering Sciences at Kyushu University in Japan

Positions Held

Assistant Professor, Kyushu University

Research Interests

Heat Transfer, Thermal Hydraulics

CV of Members and Invited Speakers

PROF. HUI-YU TSAI (LECTURE 8)



Personal Information

Name: Hui-Yu Tsai

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NTHU/NES



LAB

Education

National Tsing Hua University, Hsinchu, Taiwan, PhD, 2003, Nuclear Science

National Yang Ming University, Taiwan, BS, 1997, Radiologic Science and Technology

Positions Held

Current position

Professor, Institute of Nuclear Engineering and Science, National Tsing Hua University, Hsinchu, Taiwan
Affiliated Professor, Department of Engineering and System Science, National Tsing Hua University.

Academic Appointments

Associate Professor (2017 ~ 2021), Institute of Nuclear Engineering and Science, National Tsing Hua University

Associate Professor (2010 ~2017), Department of Medical Imaging and Radiological Sciences, Chang Gung University

Assistant Professor (2008~ 2010), Department of Medical Imaging and Radiological Sciences, Chang Gung University

Assistant Professor (2003~2008), Department of Medical Imaging and Radiological Sciences, Chung Shan Medical University

Joint Appointment Research Professor (2016 ~ 2017), Department of Medical Imaging and Intervention, Chang Gung Memorial Hospital Linkou.

Administrative Appointments

Director, Medical Physics Research Center, Institute for Radiological Research, Chang Gung University, Taoyuan, Taiwan, 02/2014-07/2016

Honors and Awards

Eminent Scientist of the Year 2004, International Research Promotion Council, India, 2005

Summa Cum Laude Award (Oral), CSMP Annual Meeting, 2020

Outstanding Teaching Award, College of Nuclear Science, National Tsing Hua University, 2020

CV of Members and Invited Speakers

PROF. HUI-YU TSAI

Research Interests

Dr. Tsai has 18 years of experience in radiation protection in medicine. Her research interest is on consideration of radiation safety regarding patients and medical staff in diagnostic imaging and radiation therapy. She has been collaborating with clinicians and scientists in radiology and radiotherapy. Her current research directions include the development of LET detector, national collective effective dose in medicine and occupational dose. Current research topics include (1) Development of LET detector for in-vivo measurements in Heavy Ion; (2) Study of medical radiation exposure for cone-beam computed tomography (CBCT) guided pulmonary intervention Therapy; (3) Impact of the adoption of eye-lens dose limit suggested by ICRP Report No. 118 on clinical medical workers: Survey of Hp(3) from occupational exposure of interventional and cardiological procedures and nuclear medicine; (4) Investigation on Medical Radiation Exposure of the Taiwan Population.

Lecture Topic & Abstract

Radiation Protection and Safety in Medicine

This talk will briefly introduce the facilities used in medicine, such as X-ray units, interventional and fluoroscopic units, Computed Tomography (CT) scanners, PET/CT scanners, and Linac machines. The safe use of ionizing radiation in medicine is a very important issue. This talk also addresses radiation protection from several aspects, i.e. Radiation Protection in Radiography, Dental Radiology, and Fluoroscopy Guided Interventional Procedures. The quality assurance related to CT Radiation Dose Management and Safety and Quality in Radiotherapy will also be covered.

CV of Members and Invited Speakers

PROF. MING-WEI LIN (LECTURE 9)



Personal Information

Name: Ming-Wei Lin

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National Tsing-Hua University, Hsinchu City, 300044, Taiwan

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Website: <http://www.nes.nthu.edu.tw/people/bio.php?PID=262>

Education

Ph. D.	Nuclear Engineering – The Pennsylvania State University, USA	2010 – 2015
M. S.	Engineering and System Science – National Tsing-Hua University, Taiwan	2002 – 2004
B. S.	Engineering and System Science – National Tsing-Hua University, Taiwan	1998 – 2002

Positions Held

Associate Professor August 2020 – Current
Institute of Nuclear Engineering and Science, National Tsing-Hua University, Taiwan

Assistant Professor February 2016 – July 2020
Institute of Nuclear Engineering and Science, National Tsing-Hua University, Taiwan

Honors and Awards

Teaching Award, College of Nuclear Science, National Tsing Hua University, June 2019

Research Interests

Ultrafast optics, plasma physics and simulations, laser-based particle acceleration, laser material processing, radiation generation/detection

Lecture Topic & Abstract

Measurement of fast neutron spectra based on time-of-flight and deconvolution techniques with organic scintillators

Fast neutrons with MeV-level energies generated from fusion or proton-driven nuclear reactions can be efficiently detected by organic scintillators with the goal of characterizing energy spectra of them in a relatively simple and reliable manner. Nowadays, the schemes of time-of-flight measurement and spectrum deconvolution/unfolding represent two major approaches for retrieving fast neutron spectra from acquired detector responses. This talk aims to introduce the fundamentals of fast neutron detection with organic scintillators, as well as the conceptual reviews regarding the time-of-flight setup and the spectrum unfolding algorithms commonly used for neutron spectrometry.

CV of Members and Invited Speakers

PROF. HO JIN RYU (LECTURE 10)



Personal Information

Name: Ho Jin Ryu

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Education

- Ph.D Materials Science and Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, 2000, Feb. 18
- M.S. Materials Science and Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, 1995, Feb. 17
- B.S. Materials Science and Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, 1993, Feb. 19

Positions Held

- Associate Professor, Korea Advanced Institute of Science and Technology, 2013, Sep. – present
- Editorial Committee of “Metals and Materials International” by Springer (2020-present)
- Editors of “Functional Composites and Structures” by IOPscience (2019-present)

Honors and Awards

- Technology Innovation Award, College of Engineering, KAIST, 2019. 12
- Top 100 Technology and Leaders, Korea Academy of Engineering, 2017. 12
- Top Reviewers for the Journal of Nuclear Materials, Elsevier, 2017, 2018

Research Interests

- Nuclear Fuel Development
- Advanced Materials for Nuclear Fuel Cycle
- Fusion Plasma Facing Materials

Lecture Topic & Abstract

Nuclear Fuel Technologies

Nuclear fuel technologies are essential for the development of advanced nuclear reactors such as Generation IV nuclear energy systems. Therefore, understanding the fundamental knowledge of the fabrication, microstructure, properties and performance of various nuclear fuels is useful for the design and application of future generation reactor concepts. In this lecture, the basic elements of accident tolerant fuel, nuclear fuels for space and marine reactors, molten salt reactor fuels, 3D printing for nuclear fuel, and digital twin for nuclear fuel will be introduced.

CV of Members and Invited Speakers

PROF. YONG HOON JEONG

(COMMITTEE)



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Website: <http://necel.kaist.ac.kr>

Education

- Ph.D Nuclear and Quantum Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, 2003
- M.S. Nuclear and Quantum Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, 1998
- B.S. Nuclear Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, 1996

Positions Held

- Professor, Korea Advanced Institute of Science and Technology, 2007, Aug. – present
- Director, Center for Advanced Reactor Research, KAIST (2020-present)
- Director, KAIST-KU Joint Research Center, (2021-present)

Honors and Awards

- Prime minister's citation, 2010. 12
- Best 10 Research Works at KAIST in 2015, 2016.2

Research Interests

- Advanced Nuclear Reactor Design (Sodium Fast Reactors, Molten Salt Reactors)
- Nuclear Thermal-hydraulics (Heat Transfer, CHF, Nano-fluids)
- Nuclear Desalination and Hydrogen Production

CV of Members and Invited Speakers

PROF. HE HUI

(LECTURE 11)



Personal Information

Name: HE Hui

Address: A307 Mechanical Building 800 Dongchuan Road
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Website: <https://me.sjtu.edu.cn/en/FullTimeTeacher/hehui.html>

Education

2007~2016 Chongqing University, Bachelor, Doctor

Positions Held

Nuclear Thermal Hydraulics and Safety Analysis, Advanced Measurement Technology, Boiling Heat Transfer Enhancement, Materials and Thermal Hydraulics Coupling

Research Interests

Best paper award, The 12th International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Operations and Safety (NUTHOS-12), Oct. 2018.

Lecture Topic & Abstract

Liquid film thickness of annular two-phase flow for different geometries

Being the last flow regime that occurs before a possible dryout scenario, the liquid film behaviors of the annular two-phase flow affect not only the efficiency of the mass and energy transfers but also the safety of many heat exchange systems such as pressurized water reactors (PWR) of nuclear power plants during a hypothetical LOCA (loss of coolant accident), steam generators and boiling water reactors (BWR) during normal operation. The major focus of the current lecture is the measurement of liquid film thickness of annular two-phase flow in different geometries by using high-speed camera and conductivity-based techniques, in which the liquid film behaviors including the liquid film thickness, interfacial waves etc., are also discussed.

CV of Members and Invited Speakers

PROF. KUAN-CHE LAN (LECTURE 12)



Personal Information

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Website: <https://sites.google.com/gapp.nthu.edu.tw/nemrl/Members>

Education

2012-2017, Ph.D. in Nuclear, Plasma, and Radiological Engineering, University of Illinois, Urbana-Champaign, USA.

2004-2007, M.S. in Engineering and System Science, National Tsing Hua University, Taiwan.

2000-2004, B.S. in Engineering and System Science, National Tsing Hua University, Taiwan.

Positions Held

Current position (2019-)

- Assistant Professor, Institute of Nuclear Engineering and Science, National Tsing Hua University
- Affiliated Assistant Professor, Department of Engineering and System Science, National Tsing Hua University

Past Position

2019 Associate Research fellow, Institute of Nuclear Energy Research, Taoyuan, Taiwan.

2017-2018 Postdoctoral Research Scientist, University of Nevada, Las Vegas, USA.

2008-2009 Process Engineer of Fab12 Nano-Etching Division in TSMC, Hsinchu, Taiwan.

Research Interests

Mechanical Behavior of Zircaloy and high temperature materials, Corrosion of metallic materials, High-temperature oxidation of Nickel-base alloys, Microstructure-property correlation of materials, Surface and coating technology for the application of mechanical improvement and corrosion resistant, Cellular automaton (CA) simulation on metallic materials.

Lecture Topic & Abstract

Biaxial creep performance of CWSR Zircaloy-4 cladding at emulated off-normal conditions of interim dry storage facility

Biaxial creep behavior of hydrided Zircaloy-4 cladding was tested at 500°C. Creep-life was inversely proportional to H-concentration up to 750 wppm. The weakening through hydride reorientation of tested specimen was not observed by optical microscopy. The power-law stress exponents and the TEM observation supported the high-temperature climb mechanism dominated the creep behavior in secondary stage.

CV of Members and Invited Speakers

PROF. SHAO-WEN CHEN (COMMITTEE)



Personal Information

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Email: chensw@mx.nthu.edu.tw

Website: <http://www.nes.nthu.edu.tw/>

Education

Ph.D., Purdue University, USA, 2012

M.S., National Tsing Hua University, Taiwan, 2001

B.S., National Tsing Hua University, Taiwan, 1999

Positions Held

Professor, Institute of Nuclear Engineering and Science, National Tsing Hua University, Taiwan, Aug. 2021-present

Associate Professor, Institute of Nuclear Engineering and Science, National Tsing Hua University, Taiwan, Aug. 2017-Jul. 2021

Assistant Professor, Institute of Nuclear Engineering and Science, National Tsing Hua University, Taiwan, Feb. 2013-Jul. 2017

Post Doctoral Research Associate, Nuclear Engineering, Purdue University, USA, 2012-2013

Engineer, MSTC/MIRL, Industrial Technology Research Institute, Taiwan, 2001-2007

Honors and Awards

Teaching Award, College of Nuclear Science, NTHU, Taiwan, 2015, 2018 and 2021

Outstanding Mentor Award, College of Nuclear Science, NTHU, Taiwan, Sep. 2018.

Best Paper Award, 7th IEEE International Symposium on Next-Generation Electronics (ISNE 2018), Taipei, Taiwan, May 7-9, 2018

Bililand Dissertation Fellowship, Purdue University, USA, 2011

Member, Alpha Nu Sigma National Honor Society, ANS, USA, 2010

Ross Fellowship, Purdue University, USA, 2007

Research Interests

Two-Phase Flow, Boiling Heat Transfer, Reactor Safety, Electronics Cooling

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[Shin-Rong Wu](#)
(PhD student)



[Zhi-Wei Liu](#)
(MS student)



[Zhao-Wei Fu](#)
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[Sz-Shian Wu](#)
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[Tzu-Chi Lin](#)
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KOGA Mizuki
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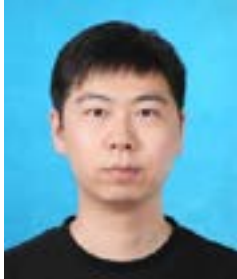
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[Minsuk Lee](#)
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[Taesuk Oh](#)
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[Yunseok Jeong](#)
(PhD student)



[Jaejin Choi](#)
(MS student)



[Nguyen Woei Jer](#)
(MS student)

Student Group Member

*The names in bold are the corresponding members of each group.

Group 1

Shin-Rong Wu (NTHU, Ph D, M)

Kun-Ni Liu (NTHU, MS, F)
Lung-Hong Huang (NTHU, MS, M)
ZHANG Ting (KU, PhD, F)
NAKAMURA Takeshi (KU, MS, M)
YAO Yao (KU, Research student, M)
Deng Jiaolong (SJTU, MS, M)
Wang Hanyu (SJTU, MS, M)
Seongmin Lee (KAIST, PhD, M)

Group 2

Wei-Mao Chen (NTHU, MS, M)

Zhi-Wei Liu (NTHU, MS, M)
An-Jia Chen (NTHU, MS, F)
UWADA Shogo (KU, MS, M)
ENDO Akihiro (KU, MS, M)
Song Houde (SJTU, Ph D, M)
Kwangho Ju (KAIST, PhD, M)
Jaejin Choi (KAIST, MS, M)

Group 3

Po-Hung Hsu (NTHU, MS, M)

Zhao-Wei Fu (NTHU, MS, M)
Mei-Lin Chen (NTHU, MS, F)
ESHITA Syoki (KU, MS, M)
KOGA Mizuki (KU, MS, M)
Li Tao (SJTU, MS, M)
Minsuk Lee (KAIST, PhD, M)
Yunseok Jeong (KAIST, PhD, M)

Group 4

Hsuan-Che Chen (NTHU, MS, M)

Sz-Shian Wu (NTHU, MS, F)
Hsin-Hung Li (NTHU, MS, M)
AKAND M.A. Rafiq (KU, PhD, M)
OMORI Kohei (KU, MS, M)
Tan Jiaqi (SJTU, MS, F)
Wooseong Park (KAIST, PhD, M)
Nguyen Woei Jer (KAIST, MS, M)

Group 5

Jian-Jie Wang (NTHU, Ph D, M)

Tzu-Chi Lin (NTHU, MS, F)
WEN Junlang (KU, PhD, M)
KITAHAR Kei (KU, MS, M)
HAYASHI Daichi (KU, MS, M)
Zang Jing (SJTU, MS, F)
Ouyang Kun (SJTU, MS, M)
Taesuk Oh (KAIST, PhD, M)



GROUP DISCUSSION INFORMATION

Major Theme:

Design and applications of the advanced small modular reactors and Gen. 4 reactor systems, focusing on the aspects of working mechanisms, safety systems & strategies, operation features, performance & efficiency, spent fuel & waste management, radiation & health physics, economics and decommissioning.

Note: The discussion aspects are suggested as above but not limited to these.

Group 1	WATER COOLED SMALL MODULAR REACTORS (LAND BASED)
Group 2	WATER COOLED SMALL MODULAR REACTORS (MARINE BASED)
Group 3	HIGH TEMPERATURE GAS COOLED SMALL MODULAR REACTORS
Group 4	FAST NEUTRON SPECTRUM SMALL MODULAR REACTORS
Group 5	MOLTEN SALT SMALL MODULAR REACTORS

MAJOR TASKS AND FOCUS OF GROUP DISCUSSIONS & PRESENTATIONS

Date	Major Tasks for Group Discussions	Focus of Presentations
Aug. 2nd (Mon.)	<p>1:30-3:50 pm (UTC+9)</p> <ul style="list-style-type: none"> • Self-introduce yourselves to group members • Select target reactors • Search for related literature • Understand system details and working mechanisms • Indicate possible issues for each aspect 	<p>4:00-5:00 pm (UTC+9) (each group: 5 mins +Q/A)</p> <ul style="list-style-type: none"> • Introductions to selected reactor systems, capabilities, working mechanisms, safety features, advantages and disadvantages • Possible issues for operation, safety and waste management • Possible strategies for the above issues
Aug. 3rd (Tue.)	<p>1:30-3:50 pm (UTC+9)</p> <ul style="list-style-type: none"> • Review the literature to find out current strategies • Categorize and analyze the state-of-art methodologies and outcomes • Propose new ideas to mitigate or avoid those issues • Develop rough designs for the new ideas • Try to formulate the new designs with equations or models 	<p>4:00-5:00 pm (UTC+9) (each group: 5 mins +Q/A)</p> <ul style="list-style-type: none"> • Existing strategies for the issues • Analyses of the state-of-art methodologies • New ideas to mitigate or avoid those issues • Rough designs of the new ideas • Formulations or models of the new designs
Aug. 4th (Wed.)	<p>1:30-3:50 pm (UTC+9)</p> <ul style="list-style-type: none"> • Perform simple calculations to show the effectiveness, capability or efficiency of the new designs • Compare with the needs of those issues • Improve or modify your designs • Perform calculations to validate the new designs • Benchmark the calculation results with existing methods 	<p>4:00-5:00 pm (UTC+9) (each group: 5 mins +Q/A)</p> <ul style="list-style-type: none"> • Capabilities, effectiveness or efficiency of the new designs • Improvement or modifications of the designs • Validations of the new designs • Benchmark of the calculation results • Strategies to further improve the designs or refine the calculations
Aug. 5th (Thr.)	<p>1:30-2:20pm (UTC+9)</p> <ul style="list-style-type: none"> • Refine the designs • Refine the calculations • Validate & verify the results • Benchmark the results • Summarize the designs 	<p>2:30-5:00pm (UTC+9) (each group: 10 mins +Q/A)</p> <ul style="list-style-type: none"> • Introductions to the systems and issues • Literature review on existing methodologies and strategies • New designs for these issues • Formulations of the new designs • Calculation results • V&V and benchmark • Conclusions • References

OTHER INFORMATION

All lectures and group discussions are organized via “Microsoft Teams” video conferencing platform. Instructions on how to install and use it can refer to the following web links.


[General information](#) (In Chinese)

[Microsoft Teams video training](#) (In English)

[Microsoft Teams video training](#) (In Japanese)

[Microsoft Teams video training](#) (In Korean)





2021

NUCLEAR ENGINEERING SUMMER SCHOOL

August 2-5, 2021
National Tsing Hua University
Hsinchu, Taiwan

KAIST

