THERMINIC 2023

((29th INTERNATIONAL WORKSHOP
Thermal Investigations of ICs and Systems **))**

SEPTEMBER 27 – 29, 2023 | BUDAPEST, HUNGARY

PROCEEDINGS 2023

CONTENT

WELCOME TO THERMINIC 2023!

The 29th THERMINIC Workshop is, again, the main European event for academics and industry to share recent advancements in thermal challenges and solutions for electronics, microelectronics, power electronics and solid-state lighting, including aspects of heat transfer at different scales, thermal testing and modelling, simulation, advanced thermal management solutions, reliability and life-time prognostics.

Following the workshops held in Grenoble (1995), Budapest (1996, 2000, 2007, 2012 and 2016), Cannes (1997 and 1998), Rome (1999), Paris (2001, 2011 and 2015), Madrid (2002), Aix-en-Provence (2003), Sophia Antipolis (2004), Belgirate (2005), Nice (2006), Rome (2008), Leuven (2009), Barcelona (2010), Berlin (2013), Greenwich (2014), Amsterdam (2017), Stockholm (2018), Lecco (2019) and two online workshops during the pandemic (2020, 2021) followed by an in-person event in Doblin (2022),THERMINIC is taking place in Budapest, Hungary again. It is exciting to continue THERMINIC as an in-person workshop again, providing opportunities for personal interactions and providing an opportunity to learn more about European research projects related to thermal and reliability issues, such as the AI-TWILIGHT H2020 ECSEL project.

The 29th THERMINIC Workshop once again features a strong technical program, with three exciting keynote presentations and an invited talk as well as 39 oral and 23 poster presentations organized in 11 oral sessions and 2 poster introduction sessions. More than 100 conference delegates from 23 countries are joining us this year.

This programme booklet has been designed as a navigator for your THERMINIC 2023 participation. It includes all the sessions, presentations, and evening events to help make the most of your stay in Budapest. Note that the days have been color-coded for easier handling.

We are delighted to welcome three distinguished representatives from academia and industry as keynote speakers at THERMINIC 2023. Szilárd Szőke (Robert Bosch Hungary), Prof. Kouchi Zhang (TU Delft) and László Balázs (Hungarian University of Agriculture and Life Sciences) will showcase challenges of thermal design verification in automotive power electronics, the art of digital twinning and possible ways to improve the performance of LED lighting. The special sessions dedicated to the AI-TWILIGHT project provide an opportunity to exchange ideas between the project consortium and the wider thermal community.

We also have a great evening programmes planned. The welcome reception on Wednesday evening will be held at the workshop venue at Hotel Marriott Budapest from where the marvellous view of the Buda Castle (a UNESCO world-heritage site) can be enjoyed. The Thursday dinner will be provided onboard of ship "Budapest" that will cruise along the downtown section of the Danube, providing a synaesthetic experience of Hungarian cuisine and the illuminated emblematic buildings of Budapest. The ship will depart from the Vigadó tér pier, next to the workshop venue.

Our thanks go to the authors for their presentations and posters, as well as to the members of the scientific committee for soliciting and selecting the right mix of contributions. We are also very grateful to our industry sponsors and exhibitors for their support of THERMINIC 2023. Last not least, we would like to thank the teams from Budapest University of Technology and Economics and mcc Agentur für Kommunikation for all their help in the organisation of THERMINIC 2023.

We look forward to an inspiring three days with you at THERMINIC 2023 in Budapest.

Prof. András Poppe
Program Chair

Bernhard Wunderle
General Chair

Tim Persoons
Vice General Chair

András Poppe
Program Chair

John Parry
Publicity Chair

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B. Wunderle, TU Chemnitz / Fraunhofer ENAS, Germany

Vice General Chair:
T. Persoons, Trinity College Dublin, Ireland

Program Chair:
A. Poppe, Budapest University of Technology and Economics, Hungary

Publicity Chair:
J. Parry, Siemens Digital Industry Software, United Kingdom

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G. Martin, Signify, The Netherlands
M. Janicki, TU Lodz, Poland
J. Parry, Siemens Digital Industry Software, United Kingdom
A. Poppe, Budapest University of Technology and Economics, Hungary
D. Schweitzer, Infineon, Germany
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C. Villa, ST Microelectronics, Italy
W. Wits, Thales, The Netherlands
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B. Wunderle	TU Chemnitz, Germany
T. Zahner	OSRAM Opto Semiconductors, Germany

WEDNESDAY OVERVIEW

Wednesday, September 27, 2023

Welcome
⏱ 9.00 am – 9.10 am
András Poppe, Budapest University of Technology &
Enonomics, HU

Keynote I:
⏱ 9.10 am – 9.50 am
**In Pursuit of Accuracy: Thermal Design Verification in
Automotive Power Electronics**
Szilárd Zsigmond Szőke, Bosch, HU
Chair: Marta Rencz, Budapest University of Technology &
Enonomics, HU

Coffee Break
⏱ 9.50 am – 10.00 am

Session 1.1: Testing and Cooling Solutions for Power Electronics
⏱ 10.00 am – 11.20 am

Coffee Break
⏱ 11.20 am – 11.50 am

Poster Introduction I
⏱ 11.50 am – 12.20 pm

Lunch and Poster Viewing
⏱ 12.20 pm – 2.00 pm

Session 1.2: Thermal Management and Cooling Solutions 1
⏱ 2.00 pm – 3.20 pm

Vendor Session 1
⏱ 3.20 pm – 3.40 pm
Chair: András Poppe, Budapest University of Technology and
Economics, HU

Coffee Break
⏱ 3.40 pm – 4.20 pm

Session 1.3: Coupled Field Modelling & Simulation
⏱ 4.20 pm – 6.00 pm

Steering Committee Meeting (by invitation only)
⏱ 6.00 pm – 6.50 pm

Welcome Reception at Budapest Marriott Hotel
⏱ 7.00 pm – 8.30 pm

↑ **BACK TO MENU**

→ **SESSION 1.1**

Session 1.1: Testing and Cooling Solutions for Power Electronics
🕐 10.00 am – 11.20 am

➜ *Session Chair: Bernhard Wunderle, TU Chemnitz (DE)*

10.00 am **Thermal Transient Tests with Programmed Powering on Wide Bandgap Power Devices with Non-monotonous and Time-variant Characteristics**
Sándor László Ress[1,2], Zoltán Sárkány[1], Márta Rencz[1,2], Gábor Farkas[1]
[1]SIEMENS DI SW, Budapest, Hungary; [2]Budapest University of Technology and Economics, Budapest, Hungary

10.20 am **Applicability of JESD51-14 to Clip-bonded, Discrete Power Devices**
Szilárd Zsigmond Szőke, Henrik Sebők
Robert Bosch Kft., Hungary

10.40 am **Modular Design of Cold Plate for Cooling Power Module – Application to LV100 Packaging Module Silicon Carbide**
Wahid Cherief, Mickael Vahier, Mariya Pektova, Yannick Moison, Jérôme Giolat
MERSEN, France

11.00 am **An Advanced Cooling Solution for High Voltage and Power Density Modules**
Amin Salim Al-Hinaai[1,2], Till Huesgen[1], Cyril Buttay[2], Eric Vagnon[2], Ettinger Ildiko[3], Besar Asllani[4], Céline Combettes[5]
[1]Electronics Integration Laboratory, University of Applied Sciences Kempten, Germany; [2]Univ Lyon, CNRS, INSA Lyon, Villeurbanne, France; [3]CeramTec GmbH, Plochingen, Germany; [4]SuperGrid Institute, Villeurbanne, France; [5]Laboratoire plasma et conversion d'énergie, Toulouse, France

11.20 am – **Coffee Break**
11.50 am

↑ **BACK TO MENU**

→ **POSTER INTRODUCTION I**

Poster Introduction I
🕐 11.50 am – 12.20 pm

➜ *Session Chair: John Janssen, NXP Semiconductors (NL)*

01 **HexMG: A Circuit-Model Based Finite Multi-Domain Simulator**
László Pohl
Budapest University of Technology and Economics, Hungary

02 **Thermal Reduced Order Modelling of Multiple Power Modules on a Forced Air Heat Sink**
Kajol Kulkarni, Pietro Botazzoli
Siemens AG, Germany

03 **Discrete Packaged Power Diode's Electro-thermal Behaviour Modelling Method in a Standard CAD Environment**
Lilas Montaner[1], Achraf Kaïd[2], Fabrice Roqueta[1], Luc Hébrard[2], Jean-Baptiste Kammerer[2]
[1]STMicroelectronics, France; [2]ICube-CNRS, Strasbourg, France

04 **Analysis of Innovative Direct Coolers Manufacturable by Plastic 3D Printing for Modular Power Devices**
Nicola Delmonte, Paolo Cova, Davide Spaggiari, Danilo Santoro, Corrado Sciancalepore, Roberto Menozzi
University of Parma, Italy

05 **Analysis of the Performance of Different Packaging Technologies During Power Cycling Test**
Bhanu Pratap Singh[1], Khaled Redwan Choudhury[2], Staffan Norrga[1], Konstantin Kostov[3], Hans-Peter Nee[1]
[1]KTH Royal Institute of Technology, Sweden; [2]University of Warwick, UK; [3]Research Institutes of Sweden (RISE), Sweden

06 **A Simple and Effective Power Derating Strategy Based on Junction Temperature Estimation Improving Both Performance and Reliability**
Andrea Lamanuzzi, Andrea Pastore, Maurizio Tranchero, Claudio Romano, Paolo Santero
Ideas & Motion, Italy

07 **Thermal Challenges in Design of Data Processing Electronics for Cubesats**
Artur Jurkowski[1,2], Marcin Wójcik[1], Kamil Lysek[1]
[1]KP Labs, Poland; [2]Silesian University of Technology, Poland

08 **Multiscale Modeling of Radiation Aggravated Thermal Outburst in 5 nm Gate All Around Nanosheet Field Effect Transistor**
Vivek Kumar[1,2], Arnab Datta[1], Sudeb Dasgupta[1]
[1]IIT Roorkee, India; [2]NIT Uttarakhand, India

09 **Interplay of Thermal and Electronic Effects in the Mott Transition of Nanosized VO2 Phase Change Memory Devices**
László Pósa[1,2], Péter Hornung[1], Tímea Nóra Török[1,2], Sebastian Werner Schmid[2], Sadaf Arjmandabasi[2], György Molnár[1], Zsófia Baji[1], Goran Dražić[3], András Halbritter[2,4], János Volk[1]
[1]Centre for Energy Research, Hungary; [2]Institute of Physics, Budapest University of Technology and Economics, Budapest, Hungary; [3]National Institute of Chemistry, Ljubljana, Slovenia; [4]ELKH-BME Condensed Matter Research Group, Budapest University of Technology and Economics, Budapest, Hungary

10 **Thermal and Acoustics Investigation of a Combined Porous Media-piezoelectric Agitator System**
Rutuja Ramchandra Bilaskar, Sripriya Ramamoorthy, Shankar Krishnan
IIT Bombay, India

→ POSTER
INTRODUCTION I

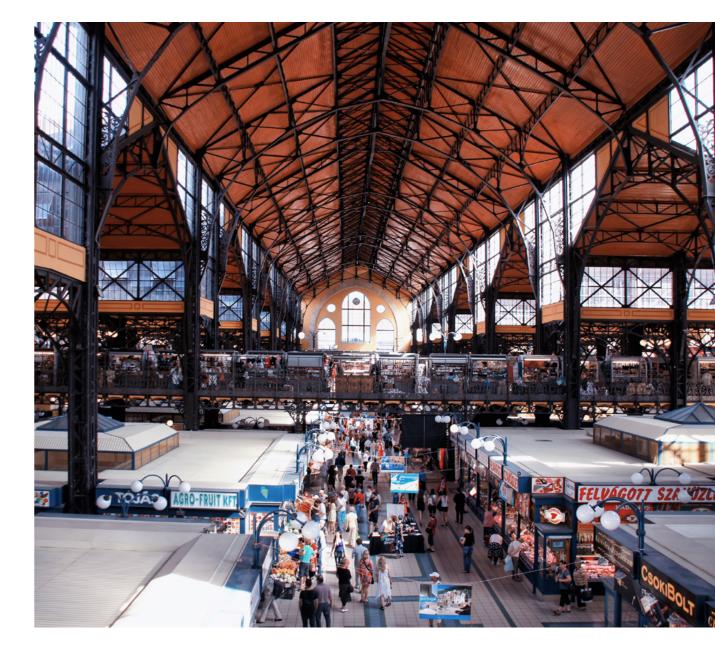11   **A Study on Optimizing Cooling Design for a Power Transformer**
        Seong Eon Kim, Jae Seop Ryu
        LS Electric, Korea, Republic of (South Korea)

12   **Development and Evaluation of a Belt Drive Fatigue Tester for**
        Accelerated Thermo-mechanical Stress Testing of Thin Metallic Films
        on Flexible Substrates
        David Walther[1], Nathanael Jöhrmann[1], Jörg Arnold[1], Bernhard Wunderle[1,2]
        [1]Chemnitz University of Technology, Germany; [2]Fraunhofer ENAS, Chemnitz,
        Germany

12.20 pm – Lunch and Poster Viewing
2.00 pm

Session 1.2: Thermal Management and Cooling Solutions
🕐 2.00 pm – 3.20 pm

➔ *Session Chair: Peter Szabo, Budapest University of Technology and Economics (HU)*

2.00 pm **Enabling Short-Term Over-current Capability of SiC Devices using Microchannel Cooling**
Shubhangi Bhadoria, Soundhariya G S, Hans-Peter Nee
KTH Royal Institute of Technology, Sweden

2.20 pm **Optimization of Hollow Hybrid Fin Heat Sinks Under Natural Convection**
Wooheon Noh, Kyoung Joon Kim
Pukyong National University, Korea, Republic of (South Korea)

2.40 pm **Experimental Investigation of Pumped Two-phase Flow Boiling using Different Finned and Pin Fin Structures on Interchangeable Heater Modules**
Ralph Schacht[1], Tobias Gruen[2], Daniel May[3], Marcus Schulz[2], Torsten Nowak[2], Jörg Arnold[3], Bernhard Wunderle[3]
[1]BTU Cottbus-Senftenberg, Germany; [2]Berliner Nanotest und Design GmbH, Germany; [3]Technische Universität Chemnitz, Germany

3.00 pm **Observer Based Junction Temperature Estimation: 3D Simulations and Experimentations**
Tychique Kabwangala Nzalalemba[1], Jean-Pierre Fradin[2], Yassine Ariba[3], Alexandre Marie[2], Frédéric Gouaisbaut[4]
[1]LAAS-CNRS, Faculté d'ingénierie ULC-Icam, Kinshasa, D.R. Congo; [2]Icam site de Toulouse, Toulouse, France; [3]LAAS-CNRS, Université de Toulouse, CNRS, INSA, Toulouse, France; [4]LAAS-CNRS, Université de Toulouse, CNRS, UPS, Toulouse, France

3.40 pm – 4.20 pm **Coffee Break**

Session 1.3: Coupled Field Modelling & Simulation
🕐 4.20 pm – 6.00 pm

➔ *Session Chair: Wendy Luiten, WLC (NL)*

4.20 pm **A Simple Electrothermal Compact Model for SiC MPS Diodes Including the Snapback Mechanism**
Vincenzo d'Alessandro, Vincenzo Terracciano, Alessandro Borghese, Marco Boccarossa, Andrea Irace
University of Naples Federico II, Italy

4.40 pm **Improving the Thermal Ruggedness of GaAs HBTs Through Nonuniform Base Ballasting Optimization**
Antonio Pio Catalano[1], Ciro Scognamillo[1], Peter J. Zampardi[2], Lorenzo Codecasa[3], Vincenzo d'Alessandro[1]
[1]University Federico II, Naples, Italy; [2]Qorvo, Inc., Newbury Park, CA, USA; [3]Politecnico di Milano, Milan, Italy

5.00 pm **Improved Nonlinear Electrothermal Simulation of Bipolar Transistors: Application to InP/InGaAs DHBTs**
Ciro Scognamillo[1], Antonio Pio Catalano[2], Giuseppe Della Ragione[1], Markus Müller[2], Michael Schröter[2], Lorenzo Codecasa[3], Vincenzo d'Alessandro[1]
[1]Department of Electrical Engineering and Information Technology, University Federico II, Naples, Italy; [2]Chair for Electron Devices and Integrated Circuits (CEDIC), TU Dresden, Germany; [3]Department of Electronics, Information and Bioengineering, Politecnico di Milano, Milan, Italy

5.20 pm **A Fast and Reliable a Simulator for the Evaluation of Losses in Power Devices Based on a Mixed Analytical and Empirical Model**
Lorenzo Giraudi, Maurizio Tranchero, Claudio Romano, Paolo Santero
Ideas & Motion, Italy

5.40 pm **Performance Analysis of Stacked Photovoltaic-thermoelectric Generator Using Mathematical Thermal-electrical Model**
Ahmed I M Alnahhal[1,2], Balázs Plesz[1]
[1]Budapest University of Technology and Economics, Hungary; [2]University of Palestine, Palestine

Thursday, September 28, 2023

Keynote II:
🕐 8.20 am – 9.00 am
Making Digital Twin Work
Kouchi Zhang, TU Delft
Chair: Genevieve Martin, Signify (Philips Lighting), NL

Session 2.1: Advances in Data Processing of Thermal Transients and Compact Modelling
🕐 9.00 am – 10.20 am

Coffee Break
🕐 10.20 am – 10.30 am

Session 2.2: Thermal Management and Cooling Solutions 2
🕐 10.30 am – 11.50 am

Poster Introduction II
🕐 11.50 am – 12.20 pm

Lunch and Poster Viewing
🕐 12.20 pm – 2.00 pm

Session 2.3: Optimization, Numerical Analysis, Machine Learning
🕐 2.00 pm – 3.00 pm

Coffee Break
🕐 3.00 pm – 3.30 pm

Vendor Session 2
🕐 3.30 pm – 3.50 pm
Chair: András Poppe, Budapest University of Technology & Enonomics, HU

Session 2.4: New Concepts for Data Center Cooling
🕐 3.50 pm – 4.50 pm

Announcement of the Details of the Social Program
🕐 4.50 pm – 5.10 pm

Social Program: Cruise on the Danube, Dinner
🕐 6.30 pm – 9.30 pm

↑ **BACK TO MENU**

→ **SESSION 2.1 – 2.2**

Session 2.1: Advances in Data Processing of Thermal Transients and Compact Modelling
🕐 9.00 am – 10.20 am

➔ *Session Chair: Gabor Farkas, SIEMENS DISW (HU)*

9.00 am   **Tridiagonal Approaches for Network Identification by Deconvolution**
Nils J. Ziegeler[1,2], Peter W. Nolte[3], Stefan Schweizer[1,3]
[1]South Westphalia University of Applied Sciences, Germany; [2]Hella GmbH & Co. KGaA, Germany; [3]Fraunhofer IMWS, Germany

9.20 am   **Structure Curve Representation of Dynamic Thermal Multi-ports**
Lorenzo Codecasa[1], Vincenzo d'Alessandro[2], Antonio Pio Catalano[2], Ciro Scognamillo[2], Dario D'Amore[1]
[1]Politecnico di Milano, Milan, Italy; [2]Università Federico II, Naples, Italy

9.40 am   **Accuracy Comparison of T3ster-master and Optimization-based Network Identification**
Nils J. Ziegeler[1,2], Peter W. Nolte[3], Stefan Schweizer[1,3]
[1]South Westphalia University of Applied Sciences, Germany; [2]Hella GmbH & Co. KGaA, Germany; [3]Fraunhofer IMWS, Germany

10.00 am   **Boundary Condition Independent Compact Thermal Models Enhanced by Contour Elements**
Lorenzo Codecasa[1], Vincenzo d'Alessandro[2], Antonio Pio Catalano[2], Ciro Scognamillo[2], Dario D'Amore[1]
[1]Politecnico di Milano, Milan, Italy; [2]Università Federico II, Naples, Italy

10.20 am – 10.30 am   **Coffee Break**

Session 2.2: Thermal Management and Cooling Solutions 2
🕐 10.30 am – 11.50 am

➔ *Session Chair: Tim Persoons, Trinity College Dublin (IE)*

10.30 am   **Effect of Leading Edge Geometry on the Thermal Performance of Plate-fin Heat Sinks with Forced Convection at Transitional Reynolds Numbers**
Gearóid Farrell[1], Rajesh Nimmagadda[1], Shailesh N. Joshi[2], Danny J. Lohan[2], Tim Persoons[1]
[1]Trinity College Dublin, Ireland; [2]Toyota Research Institute of North America (TRINA), USA

10.50 am   **To Bend or Not to Bend: Impact on Heat Pipe Performance**
Wessel W. Wits, Rick Groot, Davoud Jafari
University of Twente, Enschede, The Netherlands

11.10 am   **Definition of a Common Parameter Set for Heterogeneous Heat Sink Shapes**
Ine Vandebeek, Sarah da Silva Andrade, Lieven Vervecken, Yogesh Sovani
Diabatix, Belgium

11.30 am   **Experimental Investigation of an Ultra-thin Vapour Chamber with Water and Pure 2-Propanol as Working Fluids**
Arunjoy Baruah, John Mathew, Shankar Krishnan
Indian Institute of Technology Bombay, India

↑ **BACK TO MENU**

→ **POSTER INTRODUCTION II**

Poster Introduction II
🕐 11.50 am – 12.20 pm

➔ *Session Chair: Marta Rencz, Budapest University of Technology & Economics (HU)*

01 **Antigravity Heat Pipe with Multisectional Powder Wick**
Victor Maziuk, Valery Aliakhnovich, Aliaxandar Ilyushchanka, Pawel Ancheuski
O.V. Roman Powder Metallurgy Institute, Belarus

02 **Effect of Conductive Particle Networks on the Effective Thermal Conductivity of a Thermal Interface Material**
Julia Lucia Mayer[1,2], Andreas Griesinger[1], Norbert Willenbacher[2]
[1]*Cooperative State University (DHBW) Stuttgart, Germany;* [2]*Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany*

03 **The Impact of Additively Fabricated Lattice Geometry on Liquid-cooling Heat Sink Performance for Railway Applications**
Ahmad Batikh[1,2], Jean-Pierre Fradin[1], Antonio Castro Moreno[3]
[1]*Icam School of Engineering, Toulouse Campus, France;* [2]*Institut Clément Ader (ICA), Toulouse, France;* [3]*IRT Saint Exupéry, Toulouse, France*

04 **Two-phase Cooling System for Electric Vehicles' Battery Based on a 3D Pulsating Heat Pipe**
Luca Cattani[1], Matteo Malavasi[1], Fabio Bozzoli[1], Valerio D'alessandro[2], Luca Giammichele[2], Alessandro Benelli[1]
[1]*University of Parma, Italy;* [2]*Università Politecnica delle Marche, Italy*

05 **Investigation of Thermal Design Issues of a Bimaterial MEMS**
Elemér Dávid Deák, Balázs Plesz, Péter Gábor Szabó
Budapest University of Technology and Economics, Hungary

06 **CFD Modelling of the Heat Transfer of Photovoltaic Modules**
Péter Pálovics, Márton Németh
Budapest University of Technology and Economics, Hungary

07 **Alumina Ceramics Without Sintering Additives as Potential Substrates for Integrated Circuits**
Katalin Balazsi, Mónika Furkó, Haroune R. Ben Zine, Tamás Kolonits, Csaba Balázsi
Centre for Energy Research, Hungary

08 **3D Finite Element Modelling of Heat Transfer in Continuous Flow Two-phase Droplet Microfluidic Systems Using On-chip Thermal Control**
Zsombor Szomor[1,2], Eszter L. Tóth[1], Péter Fürjes[1]
[1]*Microsystems Lab., Inst. of Technical Physics and Materials Science, Centre for Energy Research, Hungary;* [2]*Doctoral School on Materials Sciences and Technologies, Óbuda University, Hungary*

09 **Comparison of Thermal Behaviour of Commercial Packages for Power Devices**
Lorenzo Giraudi, Maurizio Tranchero, Claudio Romano, Paolo Santero
Ideas & Motion, Italy

10 **SPICE Modeling of Insulator-Metal Transition Devices with Hysteresis**
Mahmoud Darwish, László Pohl
Budapest University of Technology and Economics, Budapest, Hungary

11 **A Simple Self-exciting Vibration High Cycle Fatigue Tester for Accelerated Stress Testing of Thin Films**
Arash Mohammadi[1], Majid Tavakolibasti[1], Jörg Arnold[1], Bernhard Wunderle[1,2]
[1]*TU Chemnitz, Germany;* [2]*Fraunhofer ENAS, Chemnitz, Germany*

12.20 pm – 2.00 pm **Lunch and Poster Viewing**

Session 2.3: Optimization, Numerical Analysis, Machine Learning
🕐 2.00 pm – 3.00 pm

→ *Session Chair: Lorenzo Codecasa, Politecnico di Milano (IT)*

2.00 pm — **Optimising Impinging Microjet Arrays for Varying Heat Source Size in Liquid Cooled Coldplates**
Jonathan William Elliott[1], Gerard Byrne[1], Anthony James Robinson[1,2]
[1]*AMBER Research Centre, Trinity College Dublin, Ireland;* [2]*School of Engineering, Trinity College Dublin, Ireland*

2.20 pm — **Topology Optimization for the CFD Design of Heat Sinks Coupled with Phase Change Materials**
Leonardo Abate[1], Nicola Bianco[2], Andrea Fragnito[2], Marcello Iasiello[2], Gerardo Maria Mauro[1]
[1]*Università degli Studi del Sannio, Italy;* [2]*Università degli Studi di Napoli Federico II, Italy*

2.40 pm — **A Machine Learning Model for the Detection of Solder Voids with Adjacent Sensors**
Nils Jahn, Patrick Sina, Martin Pfost
TU Dortmund University, Germany

3.00 pm – — **Coffee Break**
3.30 pm

Session 2.4: New Concepts for Data Center Cooling
🕐 3.50 pm – 4.50 pm

→ *Session Chair: Vadim Tsoi, Huawei Technologies Sweden AB (SE)*

3.50 pm — **Reduced-order Model for Predicting Aerodynamic Performance of Dual Impeller Fans in Data Centre Cooling Systems**
Wenguang Zhao, Sahan Wasala, Tim Persoons
Trinity College Dublin, Ireland

4.10 pm — **Thermal Robust Design Considerations for a Forced Convection Immersion Tank**
Wendy Luiten
WLC, The Netherlands

4.30 pm — **AI-assisted Characterization of Cooling Patterns in a Water-cooled ICT Room**
Vlatko Milic[1,2], Linus Kåge[1], Maria Andersson[1], Jim Enkel[3], Bahram Moshfegh[1,2]
[1]*Department of Management and Engineering, Linköping University, Linköping, Sweden;* [2]*Department of Technology and Environment, University of Gävle, Gävle, Sweden;* [3]*Ericsson AB, Linköping Lab Operations, Linköping, Sweden*

4.50 pm – — **Announcement of the Details of the Social Program**
5.10 pm

Friday, September 29, 2023

Keynote III:
🕐 8.30 am – 9.10 am
Challenges and Opportunities to Improve the Performance of LED Lighting
Dr. László Balázs, Hungarian University of Agriculture and Life Sciences
Chair: András Poppe, Budapest University of Technology & Enonomics, HU

Session 3.1: AI-TWILIGHT Session 1: Thermal, Optical and Powercycling Testing and Modelling of LED Packages
🕐 9.10 am – 10.30 am

Coffee Break
🕐 10.30 am – 10.40 am

Session 3.2: AI-TWILIGHT Session 2: Modelling of LEDs
🕐 10.40 am – 11.40 pm

Coffee Break
🕐 11.40 am – 11.50 am

Session 3.3: Thermal Investigation of LEDs and PV Cells
🕐 11.50 am – 12.50 pm

Lunch
🕐 12.50 pm – 2.00 pm

Session 3.4: Thermal & Reliability Testing
🕐 2.00 pm – 3.00 pm

Coffee Break
🕐 3.00 pm – 3.10 pm

Best Paper and Best Poster Awards Ceremony
🕐 3.10 pm – 3.20 pm
Chair: András Poppe, Budapest University of Technology & Enonomics, HU

Closing Remarks
🕐 3.20pm - 3.30pm
Announcement of the 30th THERMINIC Workshop
Chair: Bernhard Wunderle, TU Chemnitz, DE

Session 3.1: AI-TWILIGHT 1: Thermal, Optical and Powercycling Testing and Modelling of LED Packages
🕐 9.10 am – 10.30 am

→ *Session Chairs: András Poppe, University of Technology and Economics (HU) & Genevieve Martin, Signify (Philips Lighting) (NL)*

9.10 am **From Digital Twins to Use-cases: An Approach from AI-TWILIGHT**
Genevieve Martin[1], Christophe Marty[2], Marc van der Schans[1], András Poppe[3], Elke Kraker[4]
[1]Signify, Eindhoven, The Netherlands; [2]Ingelux, Lyon, France; [3]Department of Electron Devices, Budapest University of Technology and Economics, Budapest, Hungary; [4]Materials Center Leoben Forschung GmbH, Leoben, Austria

9.30 am **Design of Power Cycling for Reliability Testing of LED Systems: Numerical and Analytical Approach**
Lisa Mitterhuber, Julien Magnien, Elke Kraker
Materials Center Leoben Forschung GmbH, Austria

9.50 am **Automated Peak Detection for Analysis of Error Propagations and Validation of Structure Functions in Reliability Tests of LED Systems**
Sandra Fischer, Julien Magnien, Heiko Röthl, Lisa Mitterhuber, Elke Kraker
Materials Center Leoben Forschung GmbH, Austria

10.10 am **On the Importance of Fast and Accurate LED Optical and Thermal Characterization: From Visible Use Cases to UV Technologies**
Nicola Trivellin[1,2], Nicola Roccato[2], Francesco Piva[2], Matteo Buffolo[2], Carlo De Santi[2], Claudio Narduzzi[2], Riccardo Fraccaroli[2], Alessandro Caria[2], Gaudenzio Meneghesso[2], Enrico Zanoni[2], Matteo Meneghini[2,3]
[1]DII - University of Padova, Italy; [2]DEI - University of Padova, Italy; [3]Department of Physics and Astronomy, University of Padova, Italy

10.30 am – **Coffee Break**
10.40 am

Session 3.2: AI-TWILIGHT 2: Modelling of LEDs
🕐 10.40 am – 11.40 pm

→ *Session Chair: Genevieve Martin, Signify (Philips Lighting) (NL)*

10.40 am **An Automated Method for Creating Compact Dynamic Thermal Models for In-situ Prognostics of Power Electronics and Power LED Packages**
András Poppe, Gusztáv Hantos, János Hegedüs, Ferenc Ender
Department of Electron Devices, Budapest University of Technology and Economics, Budapest, Hungary

11.00 am **The Minimal Set of IVL Measurements to Characterize Power LED Chips**
Márton Németh, Gusztáv Hantos, János Hegedüs
Department of Electron Devices, Budapest University of Technology and Economics, Budapest, Hungary

11.20 am **Bayesian Experimental Design for LEDs Using Gaussian Processes**
Peter Förster[1,2], Sebastian Schöps[1], Wil Schilders[2], Stephan Böckhorst[3], Maximilian Mevenkamp[3]
[1]Technical University of Darmstadt, Germany; [2]Eindhoven University of Technology, The Netherlands; [3]Hella GmbH & Co. KGaA, Germany

11.40 am – **Coffee Break**
11.50 am

→ **SESSION 3.3 – 3.4**

Session 3.3: Thermal Investigation of LEDs and PV Cells
🕐 11.50 am – 12.50 pm

➔ *Session Chair: János Hegedüs, Budapest University of Technology and Economics (HU)*

11.50 am **Transient Thermal Analysis for VCSEL Diodes**
Maximilian Schmid[1], Marcel Momberg[2], Marcel Kettelgerdes[2], Gordon Elger[1]
[1]*Fraunhofer IVI, Germany;* [2]*Technische Hochschule Ingolstadt, Germany*

12.10 pm **Impact of LED Temperature on the Performance of LiFi Optical Wireless Communication Links**
Diego Rodolfo Vargas Romero[1], Jean-Paul M.G Linnartz[1,2], Jacobus L.M van Mechelen[1]
[1]*Eindhoven University Technology, The Netherlands;* [2]*Signify (Philips Lighting) Research, The Netherlands*

12.30 pm **Thermal Behavior of Crystalline Silicon Bottom Cell in a Monolithic Perovskite/Si Tandem Solar Cells**
Ahmad Halal Alshahmani, Balázs Plesz
Budapest University of Technology and Economics, Hungary

12.50 pm – **Lunch**
2.00 pm

Session 3.4: Thermal & Reliability Testing
🕐 2.00 pm – 3.00 pm

➔ *Session Chair: Patrick Tounsi, LAAS - CNRS (FR)*

2.00 pm **Analysing Thermographic and Electrically Measured Thermal Transients of High-power LEDs**
Simon H. Anke[1], Nils J. Ziegeler[1,2], Peter W. Nolte[3], Stefan Schweizer[1,3]
[1]*Faculty of Electrical Engineering, South Westphalia University of Applied Sciences, Germany;* [2]*Thermal Management Department, Hella GmbH & Co. KGaA, Germany;* [3]*Fraunhofer Application Center for Inorganic Phosphors, Branch Lab of Fraunhofer IMWS, Germany*

2.20 pm **Thermal Test Vehicle for HPC – System Level Approach for Investigation of the Thermal Heat Path Signature with the Property of Spatial Resolution**
Maik Sternberg[1], Daniel May[1,2], Kaushal Arun Pareek[1,2], Volker Bader[4], Karl-Friedrich Becker[4], Bernhard Wunderle[2,3], Mohamad Abo Ras[1]
[1]*Berliner Nanotest und Design GmbH, Germany;* [2]*Chemnitz University of Technology, Germany;* [3]*Fraunhofer ENAS, Germany;* [4]*Fraunhofer IZM, Germany*

2.40 pm **Reliability Tests of the Surface-mounted Power MOSFETs Soldered using SAC0307-TiO2 Composite Solder Paste**
Paweł Górecki[1], Adrian Pietruszka[1], Agata Skwarek[1], Balazs Illes[2]
[1]*Gdynia Maritime University, Poland;* [2]*Budapest University of Technology and Economics, Hungary*

3.10 pm – **Best Paper and Best Poster Awards Ceremony**
3.20 pm

3.20 pm – **Closing Remarks**
3.30 pm **Announcement of the 30th THERMINIC Workshop**

THERMINIC 2023

**CONFERENCE PROGRAM CHAIR &
LOCAL ORGANIZING COMMITTEE**
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Ildikó Németh

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→ **NOTES**