

Conference Programme

11th April

08:00-17:00 **Registration**

09:00-09:15 **Welcome**

Session 1 - New Developments in Solution Methods of the Radiative Transfer Equation

Chairman – Kyle Daun

09:15-09:40 A Parallel Implicit Mixed-FEM Solution for Complex Domain Radiative Transfer Problems Using Immersed Meshes

M. A. Badri^{1,2}, Y. Favennec², P. Jolivet³, S. Le Corre² and B. Rousseau²

¹Institut de Recherche Technologique Jules Verne, France

²CNRS, Laboratoire de Thermique et Énergie de Nantes, France

³CNRS, Institut de Recherche en Informatique de Toulouse, France

09:40-10:05 Angular Adaptivity with Finite Elements on Ball-Triangulation for Efficient Numerical Solutions of Radiative Transfer Equation

Y. Favennec, M. A. Badri, T. Mathew and B. Rousseau

CNRS, Laboratoire Thermocinétique de Nantes, France

10:05-10:30 Polarized Radiative Transfer in Participating Media with Irregular Geometries Using the Discontinuous Finite Element Method

Cun-Hai Wang, Lei Qu, Yong Zhang and Hong-Liang Yi

School of Energy Science and Engineering, Harbin Institute of Technology, P. R. China

10:30-10:50 **Coffee Break**

10:50-11:15 Radiative Transfer in a Sphere with a Combination of Specular and Diffuse Reflection at the Boundary

R. D. M. Garcia

Instituto de Estudos Avançados, São José dos Campos, Brazil

11:15-11:40 A Discrete Unified Gas Kinetic Scheme for Transient Radiative Transfer Simulations

Xiao-Ping Luo, Ya-Fen Zhao, Hong-Liang Yi and He-Ping Tan

Harbin Institute of Technology, P.R. China

Session 2 – Monte Carlo Method

Chairman - Wojciech Lipinski

- 11:40-12:05** Three Viewpoints on Null-Collision Monte Carlo Algorithms
Mouna El Hafi¹, Stephane Blanco², Jérémi Dauchet³, Mathieu Galtier⁴,
Richard Fournier², Jean-Marc Tregan² and Najda Villefranque^{2,5}
¹RAPSODEE - UMR CNRS 5302 - Mines Albi - Campus Jarlard, Albi, France
²LAPLACE-UMR CNRS 5213 -Université Paul Sabatier, Toulouse, France
³Institut Pascal, SIGMA, UMR CNRS 6602, Université Clermont Auvergne, Clermont-
Ferrand, France
⁴CETHIL, UMR CNRS 5008, Université Claude Bernard Lyon 1, INSA-Lyon,
Villeurbanne, France
⁵CNRM, UMR CNRS 3589, Météo France, Toulouse, France
- 12:05-12:30** Symbolic Monte Carlo Methods: An Analysis Tool for the Experimental
Identification of Radiative Properties at High-Temperature
Maxime Roger, Mathieu Galtier, Frédéric André, Agnès Delmas
Univ Lyon, CNRS, INSA-Lyon, Université Claude Bernard Lyon, CETHIL,
Villeurbanne, France
- 12:30-14:00** **Lunch Break**
- 14:00-14:25** Comparison of Monte Carlo Methods Efficiency to Solve Radiative
Energy Transfer in High Fidelity Unsteady 3D Simulations
Lorella Palluotto¹, Nicolas Dumont¹, Pedro Rodrigues¹, Chai Koren²,
Ronan Vicquelin¹ and Olivier Gicquel¹
¹Laboratoire EM2C, CNRS, CentraleSupélec, Université Paris-Saclay, Gif-sur-Yvette,
France
²Air Liquide, Centre de Recherche Paris-Saclay, Les-Loges-en-Josas, France
- 14:25-14:50** Coupled Monte-Carlo – Large Eddy Simulation of a Turbulent Sooting
Diffusion Jet Flame
P. Rodrigues, O. Gicquel, B. Franzelli, N. Darabiha, R. Vicquelin
Laboratoire EM2C, CNRS, CentraleSupélec, Gif-sur-Yvette, France
- 14:50-15:15** A Combined Analytical and Monte Carlo Method for Directional
Reflectance of an Optically Dense Planetary Atmosphere
Leonid A. Dombrovsky^{1,2} and Jaona H. Randrianalisoa³
¹Joint Institute for High Temperatures, Moscow, Russia
²Tyumen State University, Tyumen, Russia
³GRESPI Laboratory, the University of Reims, Champagne–Ardenne, France

Session 3 – Turbulence-Radiation Interaction

Chairman – Mouna El Hafi

- 15:15-15:40** Direct Numerical Simulation of Turbulence Radiation Interactions in Non-Grey Media
S. Silvestri¹, D.J.E.M. Roekaerts^{1,2} and R. Pecnik¹
¹Delft University of Technology, Delft, the Netherlands
²Eindhoven University of Technology, Eindhoven, the Netherlands
- 15:40-16:05** LES of Supersonic Channel Flow between Isothermal Walls at Different Temperatures Including Thermal Radiation Effects
Utpal Baro, Susila Mahapatra, Sandeep Kumar, Somnath Ghosh and Rainer Friedrich
¹Indian Institute of Technology Kharagpur India
²Technische Universitaet Munich, Germany
- 16:05-16:25** **Coffee Break**
- 16:25-16:50** Study of Turbulence-Radiation Interactions in Large Eddy Simulations of Sandia Flame D
Flavia C. Miranda¹, Pedro J. Coelho² and Johannes Janicka¹
¹Institute of Energy and Power Plant Technology, TU Darmstadt, Germany
²Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal
- 16:50-17:15** On the Modeling of the Filtered Radiative Transfer Equation in Large Eddy Simulations of Lab-Scale Sooting Turbulent Diffusion Flames
Jean-Louis Consalvi¹, Fatiha Nmira² and Wenjun Kong³
¹Aix-Marseille Université, IUSTI/ UMR CNRS 7343, Marseille, France.
²Direction R&D EDF, Chatou, France.
³Institute of Engineering Thermophysics Chinese Academy of Sciences, North Haidian District, Beijing, P.R. China
- 17:15-17:40** Pressure Effects on Radiative Heat Transfer in Hydrogen/Air Turbulent Diffusion Flames
Fatiha Nmira¹, Jean-Louis Consalvi² and Frédéric André³
¹Direction R&D EDF, Chatou, France.
²Aix-Marseille Université, IUSTI/ UMR CNRS 7343, Marseille, France.
³Univ Lyon, CNRS, INSA-Lyon, Université Claude Bernard Lyon 1, CETHIL, Villeurbanne, France.

12th April

09:00-16:00 Registration

09:00-10:00 Plenary Lecture

Chairman – Frédéric Andre

Choice of Radiation Solvers for Coupled Heat Transfer Problems: Report on Workshop Results

John Howell

The University of Texas at Austin, Austin, TX, USA

Session 4 – Radiative Transfer in Combustion Systems

Chairman – Francis H. R. França

10:00-10:25 A Generalized Radiative Transfer Analysis in Three Dimensional Rectangular Enclosures with Non Gray Gases and Particles under the Conditions of a Reheating Furnace

Rahul Yadav¹, C. Balaji¹ and S. P. Venkateshan²

¹Indian Institute of Technology Madras, Chennai, India

²Indian Institute of Information Technology, Design and Manufacturing Kancheepuram, Chennai, India

10:25-10:50 3D-Modelling of the Radiative Heat Transfer in Rotary Kilns with a Present Bed Material

Adrian Gunnarsson¹, Klas Andersson^{1,2} and Bradley R. Adams¹

¹Chalmers University of Technology, Göteborg, Sweden

²Brigham Young University, Provo, UT, USA

10:50-11:10 Coffee Break

11:10-11:35 Sensitivity Analysis and Scale-up Considerations for Parameters Determining Radiative Heat Transfer in 3-D Particle Laden Combustion Scenarios

Tim Gronarz¹, Patric Figueiredo¹, Martin Schiemann², Reinhold Kneer¹

¹Institute of Heat and Mass Transfer, RWTH Aachen University, Aachen, Germany

²Department of Energy Plant Technology, Ruhr-Universität Bochum, Bochum, Germany

11:35-12:00 Influence of Spectral Particle Properties on the Predictive Accuracy of Gas Property Approximations

Cihan Ates, Nevin Selçuk and Gorkem Kulah

Middle East Technical University, Ankara, Turkey

Session 5 – Coupled Heat Transfer Involving Significant Radiative Effects

Chairman – John Howell

12:00-12:25 Combined Radiation and Conduction Heat Transfer Solver on Hybrid CPU-GPU Architectures

Faizan P. Siddiqui, Kaan Meneksedag, Altug M. Basol and M. Pinar Mengüç

Mechanical Engineering Department, Ozyegin University, Istanbul, Turkey

12:25-14:00 **Lunch Break**

14:00-14:25 Combined Conductive-Radiative Heat Transfer Analysis in Complex Geometry Using the Monte Carlo Method

Cyril Caliot¹, Stéphane Blanco², Christophe Coustet³, Mouna El Hafi⁴, Vincent Eymet³, Vincent Forest³, Richard Fournier² and Benjamin Piaud³

¹Processes, Materials and Solar Energy Laboratory, French National Center for Scientific Research, Odeillo, France

²Laboratoire Plasma et Conversion de l'Energie, Paul Sabatier University, Toulouse, France

³MESO-STAR SAS, Longages, France

⁴RAPSODEE, UMR CNRS 5302, MINES-ALBI Université Fédérale de Toulouse, Albi, France

14:25-14:50 Comparative Numerical Study of a Cavity with and without Radiation Including a Participating Wet Air

Ana Paula and Kamal Ismail

University of Campinas, Cidade Universitária “Zeferino Vaz”, Campinas - SP, Brazil

14:50-15:50 **Poster Session**

Fast Hybrid (3D/1D) Model for Thermal Radiative Transfer in Cirrus via Successive Orders of Scattering

T. Fauchez^{1,2}, A. Davis³, C. Cornet⁴, F. Szczap⁵, S. Platnick¹ and P. Dubuisson⁴

¹NASA Goddard Space Flight Center, Greenbelt, MD, USA

²Universities Space Research Association (USRA), Columbia, MD, USA

³Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA

⁴Laboratoire d'Optique Atmosphérique, Université Lille 1, Villeneuve d'Ascq, France

⁵Laboratoire de Météorologie Physique, Université Blaise Pascal, Clermont Ferrand, France

Modeling of Coupled Conduction-Radiation Heat Transfer Through a Non Beerian Ceramic Felt via Stochastic Techniques

Yann Dauvois¹, Franck Enguehard¹, Gérard Vignoles² and Jean Taine¹

¹Laboratoire EM2C, CNRS, CentraleSupélec, Université Paris-Saclay, Gif-sur-Yvette, France

²LCTS, CNRS, Pessac, France

Effect of Scattering Phase Function on Radiative Properties Measurement for Participating Media

Takahiro Kono¹, Hiroki Gonome² and Jun Yamada¹

¹Shibaura Institute of Technology, Koto-ku, Tokyo Japan

²Yamagata University, Yonezawa, Yamagata 992-8510, Japan

Radiative Properties of Hedgehog-Like ZnO-Au Composite Hierarchical Particles

B.W. Xie, J.M. Zhao and L.H. Liu

School of Energy Science and Engineering, Harbin Institute of Technology, Harbin, China

Thermal Radiative Properties of Heterogeneous Materials with Complex Structures

Domingos de Sousa Meneses, Alima Nzie, Olivier Rozenbaum, Cédric Blanchard, Leire del Campo and Patrick Echegut

CNRS, CEMHTI, Univ. Orléans, Orléans, France

Visible and Near-Infrared Properties of Oak Wood

J.-F. Henry¹, C. Lorreyte¹, L.A. Dombrovsky² and J.H. Randrianalisoa¹

¹GRESPI Laboratory, the University of Reims, Champagne-Ardenne, France

²Joint Institute for High Temperatures, Moscow, Russia

Validation of a Monte Carlo Ray Tracing Simulation to Calculate Spectral Emissivity on 3D Virtual Porous Samples

Olivier Rozenbaum, Cédric Blanchard, Leire del Campo, Patrick Echegut and Domingos de Sousa Meneses

CNRS, CEMHTI, Univ. Orléans, Orléans, France

Maxwell vs Ray Optics Treatments of Porous Media

C. Blanchard, A. Nzie, O. Rozenbaum, L. Del Campo, P. Echegut and D. De Sousa Meneses

CNRS, CEMHTI, Univ. Orléans, Orléans, France

Calculation of Diffusion Coefficients by Using the Infinite Medium Green's Function in the Spherical Geometry

Ayşe Kaşkaş and Mustafa Biçer

Ankara University, Faculty of Sciences, Tandoğan, Ankara, Turkey

Characterization of Thermal Properties of Ceramic Foams by a Numerically Simulated Flash Method

Morgan Sans, Olivier Farges, Vincent Schick and Gilles Parent

Simulation of Nanofluid Based Volumetric Absorption in a Solar Thermal Collector

Eckart Matthias Lange, Jan Rudolf Eggers and Stephan Kabelac

Institute for Thermodynamics, Leibniz University Hannover, Hannover, Germany

16:00-23:00 **Conference Tour and Banquet**

13th April

09:00-12:00 **Registration**

09:00-10:00 **Plenary Lecture**

Chairman – Brent Webb

Band Models of Gas Radiation: Multi-Cell Approximations and Copulas

Frédéric André

Centre d’Energétique et de Thermique de Lyon, INSA de Lyon, Villeurbanne, France

Session 6 – Gas Radiation Modelling

Chairman – Fengshan Liu

10:00-10:25 A Simplified Approach to Compute the Radiative Transfer in a Participating Medium Bounded by Non-Gray Walls

Roberta J. C. da Fonseca, Guilherme C. Fraga and Francis H. R. França

Federal University of Rio Grande do Sul, Porto Alegre, RS, Brazil

10:25-10:50 Non-Gray Radiation Study of Gas and Soot Mixtures in One-Dimensional Planar By DRESOR

Shu Zheng, Chaobo Qi and Huaichun Zhou

North China Electric Power University, Beijing, China

10:50-11:10 **Coffee Break**

11:10-11:35 WSGG Correlations for Mixtures of H₂O and CO₂ in High Pressure Conditions

Felipe R. Coelho and Francis H. R. França

Federal University of Rio Grande do Sul, Porto Alegre, RS, Brazil

11:35-12:00 Rank Transmutation Mapping Technique for the FSK and SLW Models
Frédéric André¹, Vladimir P. Solovjov², Brent W. Webb² and Denis Lemonnier³

¹Centre d’Energétique et de Thermique de Lyon, INSA de Lyon, Villeurbanne, France

²Brigham Young University, Provo, UT, USA

³ISAE-ENSMA, Futuroscope Chasseneuil, France

12:00-12:25 An Exploration of the Influence of Spectral Model Parameters on the Accuracy of the Rank Correlated SLW Model

Brent W. Webb¹, Vladimir P. Solovjov¹ and Frédéric André²

¹Brigham Young University, Provo, UT, USA

²Centre d'Énergétique et de Thermique de Lyon, INSA de Lyon, Villeurbanne, France

12:25-14:00 Lunch Break

Session 7 – Radiative Properties of Particles and Droplets

Chairman – M. Pinar Mengüç

14:00-14:25 Effect of Non-Stoichiometry on Optical Properties and Thermal Behavior of Ceria Particles under Concentrated Solar Irradiation

Vincent M. Wheeler, José Zapata, Peter Kreider and Wojciech Lipiński

The Australian National University, Research School of Engineering, Canberra, ACT, Australia

14:25-14:50 Calculations of Scattering Truncation in the Cavity Attenuated Phase Shift PM_{SSA} Monitor Using two Novel Methods

Fengshan Liu, David R. Snelling, Joel C. Corbin, Kevin A. Thomson, Gregory J. Smallwood and Prem Lobo

Measurement Science and Standards, National Research Council, Ottawa, Ontario, Canada

14:50-15:15 Evaluating Drude Models for Molten Semiconductor Nanoparticles Through Line-of-Sight-Attenuation Measurements

Kyle J. Daun¹, Jan Menser², Asif Mohammed², Thomas Dreier² and Christof Schulz²

¹University of Waterloo, Waterloo, ON, Canada

²IVG and CENIDE, University of Duisburg-Essen, Duisburg, Germany

15:15-15:40 Suppression of Pool Fires by Water Sprays: The Effect of Light Scattering by Evaporating Droplets

Leonid A. Dombrovsky^{1,2}, Siaka Dembele¹, Jennifer X. Wen³ and Ivan Sikic³

¹Depart. of Mechanical & Automotive Engineering, Kingston University, London, UK

²Joint Institute for High Temperatures, Moscow, Russia

³School of Engineering, University of Warwick, Coventry, UK

15:40-16:00 Coffee Break

Session 8 – Radiative Transfer in Dispersed Media

Chairman – Leonid Dombrovsky

16:00-15:25 A Machine Learning Approach for Modeling Radiation in Packed Beds

Mine Kaya, Hyun Hee Kang and Shima Hajimirza

Department of Mechanical Engineering, Texas A&M University, College Station, TX,
USA

- 16:25-15:50** **Characterization of Radiative Properties of a Porous Media Using the Monte Carlo Method**
Yasamin Seddighi and Farshad Kowsary
School of Mechanical Engineering, University of Tehran, Tehran, Iran
- 16:50-17:15** **Radiative Heat Transfer in Heterogeneous Media with Structural Anisotropy**
Alexandre Cattry¹, Wojciech Lipinski², and Sophia Haussener¹
¹Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland
²The Australian National University, Acton ACT, Australia
- 17:15-17:40** **Tailoring Near-Field Thermal Radiation with Mesoporous GaN and h-BN Designer Metamaterials**
Azadeh Didari¹, Elif Begüm Elçioğlu^{2,3}, Tuba Okutucu-Özyurt² and M. Pinar Mengüç¹
¹Center for Energy, Environment and Economy (CEEE), Özyeğin University, Istanbul, Turkey
²Department of Mechanical Engineering, Middle East Technical University, Ankara, Turkey
³Eskisehir Osmangazi University, Sivrihisar Vocational School, Eskisehir, Turkey
- 17:40-18:00** **Closing Session**