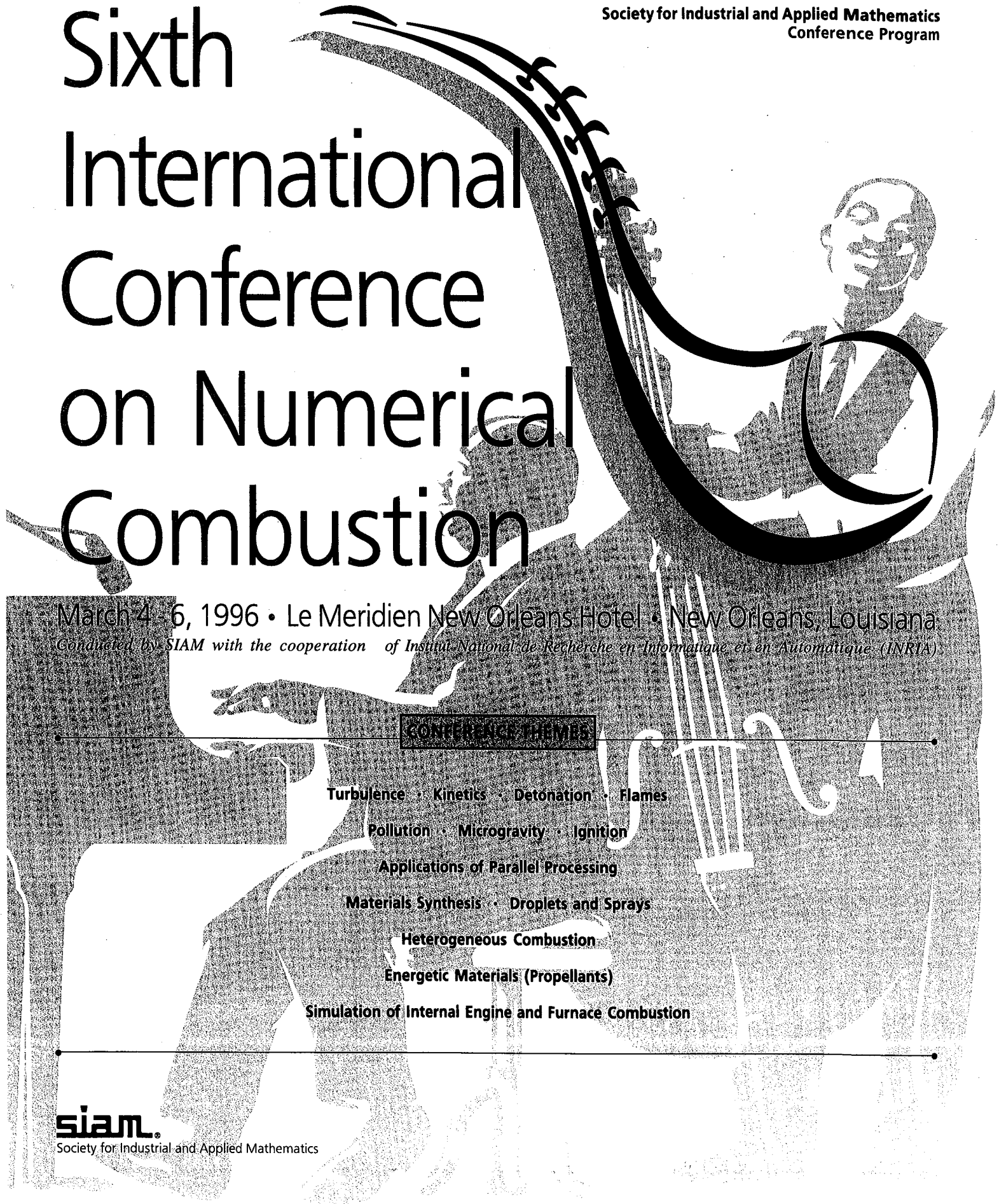
Society for Industrial and Applied Mathematics
Conference Program

Sixth International Conference on Numerical Combustion



March 4 - 6, 1996 • Le Meridien New Orleans Hotel • New Orleans, Louisiana

Conducted by SIAM with the cooperation of Institut National de Recherche en Informatique et en Automatique (INRIA)

CONFERENCE THEMES

Turbulence · Kinetics · Detonation · Flames

Pollution · Microgravity · Ignition

Applications of Parallel Processing

Materials Synthesis · Droplets and Sprays

Heterogeneous Combustion

Energetic Materials (Propellants)

Simulation of Internal Engine and Furnace Combustion

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DEADLINE DATES

Hotel Reservation
Thursday, February 1, 1996

Conference Preregistration
Tuesday, February 20, 1996

ORGANIZING COMMITTEE

- John Buckmaster (Co-Chair)
  University of Illinois, Urbana
- Mitchell D. Smooke (Co-Chair)
  Yale University
- D. Scott Stewart (Co-Chair)
  University of Illinois, Urbana
- Roland Borghi
  Université de Rouen, France
- Sebastien Candel
  Laboratoire d'Energetique Grande Voie des Vignes Ecole Centrale Paris, France
- Robert Kee
  Sandia National Laboratories, Livermore
- Bernard Larrouturou
  INRIA, Sophia-Antipolis, France
- Elaine Oran
  US Naval Research Laboratory
- Norbert Peters
  RWTH Aachen, Germany
- Bernd Rogg
  Ruhr-Universität, Germany
- Tadao Takeno
  University of Nagoya, Japan
- Jürgen Warnatz
  Universitat Heidelberg, Germany
- Charles Westbrook
  Lawrence Livermore National Laboratory
- Forman A. Williams
  University of California, San Diego

FUNDING

SIAM and the Organizing Committee are conducting this conference with the partial support of the US Department of Energy, US Office of Naval Research, and US Air Force.

GET-TOGETHERS

Welcoming Reception

Sunday, March 3, 1996

5:15 PM - 7:15 PM/Ile de France I

Complimentary beer, wine, sodas and chips and dip will be available.

PROGRAM-AT-A-GLANCE

Sunday Afternoon, March 3

5:00-7:00 **Registration opens**
Ile de France Ballroom Foyer

5:15-7:15 **Welcoming Reception**
Ile de France I

Monday Morning, March 4

7:00 **Registration opens**
Ile de France Ballroom Foyer

8:15-8:30 **Welcoming Remarks and Announcements**
John Buckmaster
Ile de France II and III

8:30-9:15 **IP1** **A Perspective on the State-of-the-Art in IC Engine Combustion Modeling**
Sherif H. El Tahry
Ile de France II and III

9:30-10:10 **Concurrent Sessions**

CP1 **Chemistry/Flame-Spread**
Ile de France II and III
CP2 **Detonation I**
Rosalie
CP3 **Turbulence I**
Maurepas
CP4 **Numerical Techniques I**
Orleans

10:10-10:40 **Coffee Break**
Ile de France I

10:40 AM-12:00 PM
Concurrent Sessions CP1, CP2, CP3, and CP4 resumed.

Monday Afternoon, March 4

12:00-1:30 **Lunch**

1:30-2:15 **IP2** **Direct Simulation and Modeling of Flame Wall Interaction**
Thierry Poinsot
Ile de France II and III

2:30-3:10 **Concurrent Sessions**

CP5 **Fire Suppression**
Ile de France II and III
CP6 **Detonation II**
Rosalie
CP7 **Turbulence II**
Maurepas
CP8 **Numerical Techniques II**
Orleans

3:10-3:40 **Coffee Break**
Ile de France I

3:40-5:40 **Concurrent Sessions**

MS1 **Simulation of Turbulent Premixed Flame Structure and Propagation**
Organizer: William Ashurst
Ile de France II and III
MS2 **Adaptive Grid Methodologies for Industrial Combustion Applications**
Organizer: John B. Bell
Rosalie
MS3 **Analysis and Control of Combustion Instabilities**
Organizer: Ben T. Zinn
Maurepas
MS4 **Numerical Combustion in the Reciprocating Heavy Duty Engine Industry – The Need and the Problems**
Organizer: William L. Brown
Orleans

Tuesday Morning, March 5

7:30 **Registration opens**
Ile de France Ballroom Foyer

8:15-8:30 **Remarks**
D. Scott Stewart
Ile de France II & III

8:30-9:15 **IP3** **The Transport of Combustion Products from Fires**
Howard R. Baum
Ile de France II and III

9:30-10:10 **Concurrent Sessions**

CP9 **Flames I**
Maurepas
CP10 **Theory**
Rosalie
CP11 **Engines/Furnaces**
Ile de France II and III
CP12 **Numerical Techniques III**
Orleans

10:10-10:40 **Coffee Break**
Ile de France I

10:40 AM - 12:00 PM
Concurrent Sessions CP9, CP10, CP11, and CP12 resumed.

Tuesday Afternoon, March 5

12:00-1:30 **Lunch**

1:30-2:15 **IP4** **Coupling of Chemical Kinetics with Flow and Molecular Transport**
Ulrich Maas
Ile de France II and III

2:30-3:10 **Concurrent Sessions**

CP13 **Flames II**
Maurepas
CP14 **Heterogeneous Combustion I**
Rosalie
CP15 **Furnaces**
Ile de France II and III
CP16 **Detonation III**
Orleans

3:10-3:40 **Coffee Break**
Ile de France I

3:40-5:40 **Concurrent Sessions**

MS5 **Numerical Methods for Premixed (Turbulent) Combustion Fronts: Design and Applicability**
Organizer: Rupert Klein
Ile de France II and III
MS6 **Parallel Computation of Combustion Problems: New Algorithm and Applications**
Organizer: Marc Garbey
Rosalie
MS7 **Computational Modeling of Energetic Materials**
Organizer: Mitchell D. Smooke
Maurepas
Poster Session
Orleans

Wednesday Morning, March 6

7:30 **Registration opens**
Ile de France Ballroom Foyer

8:15-8:30 **Closing Remarks**
Mitchell D. Smooke
Ile de France II & III

8:30-9:15 **IP5** **The Dynamics of Multidimensional Detonation**
D. Scott Stewart
Ile de France II and III

9:30-10:10 **Concurrent Sessions**

CP17 **Flames III**
Ile de France II and III
CP18 **Heterogeneous Combustion II**
Rosalie
CP19 **Turbulence III**
Maurepas
CP20 **Numerical Techniques IV**
Orleans

10:10-10:40 **Coffee Break**
Ile de France I

10:40 AM-12:00 PM
Concurrent Sessions CP17, CP18, CP19, and CP20 resumed.

Wednesday Afternoon, March 6

12:00-1:30 **Lunch**

1:30-2:15 **IP6** **Numerical Simulation of Premixed Flame Propagation in a Closed Vessel**
Kunio Kuwahara
Ile de France II and III

2:15-2:45 **Coffee Break**
Ile de France I

2:45-4:45 **Concurrent Sessions**

CP21 **Theory/Modeling**
Ile de France II and III
CP22 **Ignition/Heterogeneous/ Miscellaneous**
Rosalie
CP23 **Turbulence IV**
Maurepas
CP24 **Propellants/Algorithms**
Orleans

4:45 Conference adjourns

CP = Contributed Presentation
IP = Invited Plenary Presentation
MS = Minisymposium

Times allowed for EACH presentation, including questions and answers:
20 minutes for a CP
30 minutes for a MS
45 minutes for a IP

For papers with multiple authors, the speaker is shown in italics if known at press time.

The Organizing Committee expects every speaker of a scheduled presentation to register and attend the conference. If it becomes inevitable for a speaker to cancel her/his presentation, she or he is expected to find an alternate presenter or one of the speaker's co-authors should give the presentation.

A canceled presentation can cause serious inconvenience to the attendees and the conference organizers.

The program, including transportation, hotel, and registration information can be accessed electronically through the World Wide Web: http://www.siam.org/conf.htm

MONDAY MORNING, MARCH 4

7:00/Ballroom Foyer

Registration opens

8:15/Ile de France II & III

Opening Remarks

John Buckmaster, University of Illinois, Urbana

8:30/Ile de France II & III

IP1/Chair: Dennis N. Assanis, University of Michigan

A Perspective on the State-of-the-Art in IC Engine Combustion Modeling

Market and legislative pressures are forcing the automotive industry to seek more rapid and efficient engineering procedures. This has led to a strong desire to adopt modeling as an engineering tool, particularly for the development of internal combustion engines. This presentation reviews the state-of-the-art in the modeling of combustion in internal combustion engines. The focus is on multidimensional combustion modeling efforts, but a brief discussion on empirical-based models for "zero dimensional" analysis is also given. The review covers both homogeneous and stratified combustion. The nature of combustion in these cases is presented, as well as examples showing the type of issues that the models attempt to address. Finally, the challenges and limitations of conducting design analysis of ICE combustion systems is discussed, and a review of the likely models to succeed in the future is made. (Co-author: Daniel C. Haworth.)

Sherif H. El Tahry
Thermosciences Department
General Motors Research and Development Center

9:30 AM-12:00 PM

Concurrent Sessions

with break at 10:10-10:40

CP1/Ile de France II & III

Chemistry/Flame-Spread

Chair: Jürgen Warnatz, Universität Heidelberg, Germany

9:30 ***A Kinetic Model Describing Polyarene Growth***
Michael C. Masonjones and Adel F. Sarofim, Massachusetts Institute of Technology

9:50 ***Simplified Diffusion Model for Detailed and Reduced Reaction Mechanisms***
L.M.T. Somers, R.L.G.M. Eggels and L.P.H. de Goey, Eindhoven University of Technology, The Netherlands

10:40 ***Flow Reactor Studies and Testing of Comprehensive Mechanisms for NO_x-Reburn***
Dieter Stapf and Wolfgang Leuckel, Universität Karlsruhe, Germany

11:00 ***Modeling of H2/02/Ar Flame Structure Doped with Dimethyl Methylphosphonate***
O.P. Korobeinichev, V. V. Mokrushin, S. B. Il'in, Institute of Chemical Kinetics and Combustion, Siberian Branch Russian Academy of Sciences, Russia

11:20 ***A Numerical Study of Flame Radiation Effect on Forced Concurrent-Flow Flame Spread Over a Solid Using Discrete Ordinates Method***
Ching-Biau Jiang, *James S. T'ien* and Hsin-Yi Shih, Case Western Reserve University

11:40 ***(Title to be determined)***
Michael Delitchatsios, Factory Mutual, Norwood, MA

CP2/Rosalie

Detonation I

Chair: J.W. Dold, UMIST, United Kingdom

9:30 ***Reaction Zone Response during Detonation Initiation***
James J. Quirk and *Joseph E. Shepherd*, California Institute of Technology

9:50 ***A Numerical Simulation of Multidimensional Structure of Detonation Waves***
B. Jiang, D. M. Ingram, D. M. Causon and R. Saunders, Manchester Metropolitan University, United Kingdom

10:40 ***Level Set Methods Applied to Detonation Shock Dynamics***
Tariq D. Aslam and D. Scott Stewart, University of Illinois, Urbana

11:00 ***Two-Phase Mixture Models for Granular Explosives***
Ralph Menikoff, Los Alamos National Laboratory

11:20 ***Two-Phase Modelling of DDT: Analytical and Numerical Implications of the Limits of Equilibration***
A. K. Kapila, Rensselaer Polytechnic Institute

11:40 ***Numerical Issues and Regularization in Two-Phase Modeling of DDT***
Steven F. Son, Los Alamos National Laboratory

CP3/Maurepas

Turbulence I

Chair: To be determined

9:30 ***On the Numerical Modelling of Pool Fires in Turbulent Cross Channel Flow***
H.Y. Wang, L. Prevost, P. Joulain and J. M. Most, Université de Poitiers, France

9:50 ***Effects of Pressure Gradients on Turbulent Premixed Flames***
D. Veynante, Ecole Centrale Paris - CNRS, France; and Thierry Poinsot, IMFT - CERFACS, France

10:40 ***Three-Dimensional Direct Numerical Simulation of Turbulent Nonpremixed Combustion with Hydrogen-Oxygen Chemistry***
Christopher J. Montgomery, George Kosaly and James J. Riley, University of Washington

11:00 ***Numerical Simulation of Flame Advection and Propagation in Boundary Layers***
Yu Song, Indiana University, South Bend; and Maria Calzada, Loyola University

11:20 ***Direct Simulation of Flame Stabilization Processes***
Eric van Kalmthout, Ecole Central Paris, France; Thierry Poinsot, Institut de Mecanique des Fluides de Toulouse and CERFACS, France; and Sebastien Candel, Ecole Centrale Paris, France

11:40 ***Gradient and Counter-Gradient Scalar Transport in Turbulent Premixed Flames***
D. Veynante, Ecole Central Paris - CNRS France; A. Trouvé, Institut Francais du Petrole, France; K.N.C. Bray, Cambridge University, United Kingdom; and T. Mantel, D.E.R. - Renault, France

CP4/Orleans

Numerical Techniques

Chair: K. Kailasanath, Naval Research Laboratory

9:30 ***A Complete Flux Scheme for Combustion Problems***
J.H.M. ten Thije Boonkkamp, B. van't Hof, Eindhoven University of Technology, The Netherlands

9:50 ***Parallelizing the Numerical Solution of Laminar Diffusion Flames with Detailed Chemistry***
Alexandre Ern, CER Mathematiques, ENPC, France; Craig C. Douglas, IBM Research Division; and Mitchell D. Smooke, Yale University

10:40 ***Efficient Calculation of Instationary Flamelets with Moving Grid Techniques***
Frank Schmitt, Fabian Mauss and Henning Bockhorn, Universität Kaiserslautern Germany

11:00 ***A Higher Order Numerical Method for the Solution of Hyperbolic Systems with Relaxation***
Francois Bereux and *Lionel Sainsaulieu*, Cermics, ENPS, France

11:20 ***Integrated Time-Space Adaptive Solution of Combustion Problems Modelled by Reaction-Diffusion Systems***
Jens Lang and Jochen Frohlich, Konrad-Zuse-Zentrum für Informationstechnik Berlin, Germany

11:40 ***An Embedded Boundary Method for the Modeling of Unsteady Combustion in an Industrial Gas-Fired Burner***
Richard B. Pember, Ann S. Almgren, William Y. Crutchfield, Louis H. Howell, John B. Bell, Phillip Colella, and Vincent E. Beckner, Lawrence Livermore National Laboratory

MONDAY AFTERNOON, MARCH 4

12:00-1:30

Lunch

1:30/Ile de France II & III

IP2/Chair: To be determined

Direct Simulation and Modeling of Flame Wall Interaction

Direct Numerical Simulations (DNS) of turbulent reacting flows are used to study the interaction between flames and walls. Flame wall interaction is an essential mechanism in many practical combustion devices where it controls wall heat fluxes, unburnt hydrocarbon formation as well as flame quenching. One-, two-and three-dimensional results will be described. The speaker will show how turbulence modifies near-wall flame propagation and how quenching affects flamelets near walls. Quantitative estimates of heat fluxes during flame-wall interaction will also be given using complex chemistry computations for methane flames. Implications for modeling will be discussed and examples of applications in piston engine codes will be presented.

Thierry Poinsot
IMF Toulouse and Centre Europeen pour la Recherche et la Formation Avancee en Calcul Scientifique (CERFACS), France

2:30-3:10 PM

Concurrent Sessions

CP5/Ile de France II & III

Fire Suppression

Chair: James S. T'ien, Case Western Reserve University

2:30 ***C_1 Fluoro- and Hydrofluorocarbon Effects on the Extinction Characteristics of Methane vs. Air Counterflow Diffusion Flames***
Michael A. Tanoff, Richard R. Dobbins and Mitchell D. Smooke, Yale University; Donald R. F. Burgess, Jr., Michael R. Zachariah and Wing Tsang, National Institute of Standards and Technology; and Philip R. Westmoreland, University of Massachusetts, Amherst

2:50 ***Field Modelling of Fire Suppression by a Waterfog System***
M. An, A.C.M. Sousa and J.E.S. Venart, University of New Brunswick, Canada

CP6/Rosalie

Detonation II

Chair: James J. Quirk, California Institute of Technology

2:30 ***Numerical Modeling of Unsteady Detonation in Granulated Energetic Material***
Keith A. Gonthier and Joseph M. Powers, University of Notre Dame

2:50 ***Multi-Dimensional Simulation of DDT Experiments in Porous Energetic Materials***
Shaojie Xu and D. Scott Stewart, University of Illinois, Urbana

CP7/Maurepas

Turbulence II

Chair: To be determined

2:30 ***A Reaction Model for Heat Release in Turbulent Premixed Flames***
Hans-Peter Schmid, P. Habisreuther and W. Leuckel, Universität Karlsruhe, Germany

2:50 ***Modeling of Turbulent Mixing using the PDF Transport Equation with a Detailed and a Global Chemical Reaction Mechanism***
M. Kraft, E. Stöckelmann and H. Bockhorn, Fachbereich Chemie, Universität Kaiserslautern, Germany

CP8/Orleans

Numerical Techniques II

Chair: Frank Schmitt, Universität Kaiserslautern, Germany

2:30 ***Fast and Accurate Multicomponent Transport Property Evaluation***
Alexandre Ern, CERMICS-ENPC, France; and Vincent Giovangigli, CMAP-CNRS, France

2:50 ***A Robust and Accurate Discretization Scheme for the Computation of 1D Premixed Flames***
B. van 't Hof and A. J. M. Gielen, Eindhoven University of Technology, The Netherlands

3:10-3:40

Coffee/Ile de France I

3:40-5:40 PM

Concurrent Sessions

MS1/Ile de France II & III

Simulation of Turbulent Premixed Flame Structure and Propagation

The automobile internal combustion engine employs premixed turbulent combustion and represents one common application of our research interests. Increasing desire to remove toxic gases from auto exhaust makes detailed combustion analysis even more necessary. However, what level of chemical detail is required to design a combustion system? Flames with complex chemistry exhibit a wide range of length and time scales because the different species within the flame respond differently to strain rate and curvature changes and the possible effects upon heat release, propagation and pollutant formation are to be determined. Two-dimensional flame simulations, interacting with a turbulent flow or a single vortex, are being used to compare reduced kinetic models with detailed chemistry.

Current models of turbulent flame propagation are mostly based on an Eulerian description. Recently, a Lagrangian simulation of flame growth reveals an exponential behavior – this behavior may be considered as a finite amplitude Darrieus-Landau instability. The speakers will discuss the implications for required grid resolution to describe this experimentally observed behavior.

Organizer: William T. Ashurst
Sandia National Laboratories

3:40 ***Direct Numerical Simulations of Turbulent Premixed Methane-Air Flames***
Tarek Echekki, Jacqueline H. Chen, and Inge Gran, Sandia National Laboratories

4:10 ***The Effect of Unsteady Stretch on the Flame Structure and Extinction Characteristics in a Premixed Methane Air Flame-Vortex Interaction: DNS and Experiment***
Jacqueline H. Chen, Inge Gran, Tarek Echekki, V. Nguyen, P. H. Paul, Sandia National Laboratories

4:40 ***Low Mach Number Premixed Flame-Vortex Interaction with Detailed Chemical Kinetics***
Habib N. Najm, Sandia National Laboratories

5:10 ***Turbulent Flame Motion via Lagrangian, Two-Dimensional Vortex Dynamics***
William T. Ashurst, Organizer

MS2/Rosalie

Adaptive Grid Methodologies for Industrial Combustion Applications

Modeling of reacting flow for industrial applications is a challenging task because of the large number of physical models required to adequately describe the system and the presence of multiple length scales. In this minisymposium, we will discuss the application of modern gridding technologies to these types of problems. In particular, the speakers will address issues relating to different approaches for representing complex engineering geometries, local adaptive mesh refinement and the use of unstructured grid techniques. The presentations will focus on application of these techniques to the modeling of industrial furnaces and internal combustion engines.

Organizer: John B. Bell
Lawrence Livermore National Laboratory

3:40 ***An Adaptive Projection Method for the Modeling of Unsteady, Nonpremixed Combustion in a Gas-Fired Furnace***
Richard B. Pember, A. Almgren, John B. Bell, W. Crutchfield, L. Howell, C. Rendleman, M. Welcome, and V. Beckner, Lawrence Livermore National Laboratory; and Phillip Colella, University of California, Berkeley

4:10 ***Adaptive Mesh Refinement for the Discrete Ordinates Method***
Woodrow A. Fiveland, P. Jesse and L. Howell, Babcock and Wilcox, Alliance Ohio; and Phillip Colella, University of California, Berkeley

Monday (cont.)

4:40 ***An Object-Oriented System for Modelling Combustion in Moving Geometries on Overlapping Grids***
William Henshaw, Kristi Brislawn, David Brown, Geoff Chesshire, Dan Quinlan, Bill Rider, and Jeffrey Saltzman, Los Alamos National Laboratory

5:10 ***A Parallel, Implicit, Unstructured-Mesh Hydrodynamics Algorithm for Combustion Applications***
Peter J. O'Rourke, Los Alamos National Laboratory

MS3/Maurepas

Analysis and Control of Combustion Instabilities

Combustion instabilities often occur in propulsion systems and industrial combustors. They generally occur when energy supplied by the combustion process, via a complex interaction between flow and combustion processes, drives periodic, large amplitude, pressure oscillations within the combustor. The speakers in this minisymposium will discuss state-of-the-art approaches for analyzing and controlling such instabilities. Three of the four speakers will discuss the application of Galerkin, numerical and Large Eddy Simulation approaches to predict the behavior of unstable combustors. The fourth speaker will present application of active control approaches in damping such instabilities.

Organizer: Ben T. Zinn
Georgia Institute of Technology

3:40 ***Modal Representation of Linear and Nonlinear Instabilities in Combustion Chambers***
F. E. C. Culick, California Institute of Technology

4:10 ***Numerical Modelling of Combustion in Systems***
Vigor Yang, The Pennsylvania State University

4:40 ***Simulation and Control of Combustion Instability in Dump Combustors***
Suresh Menon, Georgia Institute of Technology

5:10 ***Active Control of Combustion Instabilities***
Ben T. Zinn, Organizer

MS4/Orleans

Numerical Combustion in the Reciprocating Heavy Duty Engine Industry - The Need and the Problems

The objective of this minisymposium is to communicate to the scientists in the numerical combustion field the needs and problems that exist in the heavy duty engine industry. There are special opportunities that make numerical combustion analysis potentially very valuable, but at the same time there are special problems that make it a grand challenge. If numerical combustion technology is to have a significant impact on the product of the heavy duty engine industry, the technology must be developed to address certain crucial needs. This minisymposium gives industrial representatives a chance to express those needs. Examples will be given of successes and failures. The intent is to address the development of product (engines) rather than research applications.

Organizer: William L. Brown
Caterpillar, Inc., Mossville, IL

3:40 ***The Need and the Problems in Numerical Combustion - The Caterpillar Story***
William L. Brown, Organizer

4:10 ***Putting More Chemistry in Numerical Combustion***
J.E. Johnston, R.G. Sunsnow, W.H. Green, Exxon Research & Engineering Corporation, Annandale, NJ

4:40 ***Modeling Needs for the Prediction of Diesel Engine Performance and Emission Characteristics***
Francois Ntone, Cummins Engine Company, Columbus, OH

TUESDAY MORNING, MARCH 5

7:30/Ballroom Foyer

Registration opens

8:15/Ile de France II & III

Remarks: D. Scott Stewart, University of Illinois, Urbana

8:30/Ile de France II & III

IP3/Chair: D. Scott Stewart, University of Illinois, Urbana

The Transport of Combustion Products from Fires

A methodology for the simulation of combustion products generated by fires both in buildings and in the open atmosphere is presented. The methods are based on high resolution solutions of the Navier-Stokes equations specialized to the convective transport of smoke and hot gases. Building fire simulations include the effects of forced ventilation, complex geometry, and water sprays. Outdoor simultations of windblown fire plumes are used to study the environmental consequences of burning marine oilspills. The underlying mathematical models are presented, and sample calculations illustrating the physical phenomena of interest are shown. Comparisons of computed predictions with experiments on widely varying scales are used to demonstrate the utility of this approach to fire modeling.

Howard R. Baum
Building and Fire Research Laboratory
National Institute of Standards and Technology

9:30 AM-12:00 PM

Concurrent Sessions

with break at 10:10-10:40

CP9/Maurepas

Flames I

Chair: Vincent Giovangigli, CMAP-CNRS, Ecole Polytechnique, France

9:30 ***Numerical Simulation of Unsteady Gas Flames at Low-Mach Number***
Francesco Saverio Marra, Università degli Studi "Federico II", Italy and Gaetano Continillo, Istituto di Richerche sulla Combustione CNR, Italy

9:50 ***Numerical Simulation of Partially Premixed Combustion using the Flamelet Approximation***
Marcus Herrmann and Bernd Binninger, RWTH-Aachen, Germany

10:40 ***The Transition from Premixed to Diffusive Character in Methane/Air vs. Air Counterflow Flames***
Michael A. Tanoff and Mitchell D. Smooke, Yale University

11:00 ***Effects of Lewis Numbers and the Scalar Dissipation Rate in Flamelet Modelling***
H. Pitsch, RWTH Aachen, Germany; and Fabian Mauss, Universität Kaiserslautern, Germany

11:20 ***Simulation of Flame Propagation by Lattice Gas Automata Models***
Akira Tsumaya, Hirotada Ohashi and Mamoru Akiyama, University of Tokyo, Japan

11:40 ***Numerical Simulation of Flame Ball Structure and Stability***
Ming-Shin Wu and Paul D. Ronney, University of Southern California

CP10/Rosalie

Theory

Chair: Moshe Matalon, Northwestern University

9:30 ***Edge-Flames and their Stability***
John Buckmaster, University of Illinois, Urbana

9:50 ***An Evolution Equation Describing the Propagation of Premixed Flames in Closed Tubes***
Moshe Matalon, Northwestern University; and Philippe Metzener, Ecole Polytechnique Federale de Lausanne, Switzerland

10:40 ***An Eigenvalue Analysis of a Two-Step, Multiphase-Flow Combustion Wave***
Stephen B. Margolis, Sandia National Laboratories, Livermore

11:00 ***Two-Dimensional Linear Stability of Detonation Waves***
Mark Short, University of Bristol, United Kingdom; and D. Scott Stewart, University of Illinois, Urbana

11:20 *Cellular Stagnation Point Flames*
Andreas G. Class, Forschungzentrum Karlsruhe GmbH, Institute of Applied Thermo- and Fluid Dynamics, Germany

11:40 *Oscillatory Behaviour Arising from a Memory-Effect in a Flame-Front*
J.W. Dold, UMIST, United Kingdom

CP11/Ile de France II & III

Engines/Furnaces

Chair: William L. Brown, Caterpillar, Inc.

9:30 *Numerical Simulation of Near-Wall Hydrocarbon Oxidation*
Thomas Hellstrom and Jerzy Chomiak, Chalmers University of Technology, Sweden

9:50 *Modeling of Autoignition of Hydrocarbon Fuels in Near Diesel Engine Conditions*
N. Levy, N. Guerrassi and J.C. Champoussin, Laboratoire de Machines Thermiques de l'Ecole Centrale de Lyon, France; N. Blin-Simiand and K. Sahetchian, Laboratoire de Mecanique Physique, CNRS URA, France

10:40 *Numerical Simulations in a Natural Gas Engine: Effect of Swirl Ratio, Bowl Geometry and Offset on Combustion*
D. Zhang, J. M. McGee and *S.H. Frankel*, Purdue University; M. Wu and K. L. Bruch, Caterpillar, Inc., Lafayette, IN

11:00 *On Turbulence Modeling for a Quasi-Dimensional SI Engine Combustion Simulation*
A. Agarwal, Z. Filipi and *D.N. Assanis*, University of Michigan, Ann Arbor; and Douglas M. Baker, MANAGE, Inc.

11:20 *Improved Gas Phase Chemistry for Furnace Simulations*
Anders Brink, Pia Kilpinen and Mikko Hupa, Abo Akademi University, Finland; Lars Kjaldman, Technical Research Centre of Finland; and K.J. Jaaskelainen, Imatran Voima Oy, Finland

11:40 *Simulation of the Combustion Processes in Pulse Combustors*
E. Lundgren and S.-I. Moller, Lund University, Sweden

CP12/Orleans

Numerical Techniques III

Chair: Alexandre Ern, CER Mathematiques, ENPC, France

9:30 *A Finite Volume Code on Unstructured Grids for Low Mach Number Reacting Flows*
Uwe Riedel, University of Heidelberg, Germany; and H. A. Dwyer, University of California, Davis

9:50 *Generalized Curvilinear Coordinate Adaptive Gridding with Application to Basic Combustion Problems*
Beth Anne Valdata, Yale University; Alexandre Ern, CMA Polytechnique, France; and Mitchell D. Smooke, Yale University

10:40 *Massively Parallel Simulations of a Turbulent Reactive Plume and a Subgrid-scale Model for Finite-rate Chemistry*
Andrew Cook and James Riley, University of Washington

11:00 *A Dynamic Adaptive Gridding Method for Laminar Flames*
Philippe Versaevel, *Nasser Darabiha* and Francois Lacas, Laboratoire EM2C, CNRS, France

11:20 *An Adaptive Bidimensional Wavelet-Vaguelette Algorithm for the Thermodiffusive Equations*
Henning Bockhorn and *Kai Schneider*, Universität Kaiserslautern, Germany; and Jochen Frohlich, Konrad-Zuse-Zentrum fur Informationstechnik Berlin, Germany

11:40 *Adaptive Numerical Modeling of a Knock Combustion Problem*
Martin Berzins, Justin Ware, C.G.W. Sheppard and J. Pan, University of Leeds, United Kingdom

TUESDAY AFTERNOON, MARCH 5

12:00-1:30

Lunch

1:30/Ile de France II & III

IP4/Chair: Jurgen Warnatz, Universität Heidelberg, Germany

Coupling of Chemical Kinetics With Flow and Molecular Transport

During the last years the interest in the numerical simulation of reacting flows has grown considerably. Numerical methods are available which allow coupling chemical kinetics with flow and molecular transport. However, the use of detailed physical and chemical models, involving more than 100 chemical species, and thus more than 100 species conservation equations, is restricted to very simple flow configurations. For practical applications, (e.g., three-dimensional turbulent flows) methods have to be devised that simplify the chemical kinetics without sacrificing accuracy. Various examples are presented for laminar and turbulent reacting flow simulations both using detailed and simplified models. It is shown that the reduced models allow a reliable description of the chemical kinetics and its coupling with flow and molecular transport.

Ulrich Maas
Konrad-Zuse-Zentrum fur Informationstechnik, Germany

2:30-3:10 PM

Concurrent Sessions

CP13/Maurepas

Flames II

Chair: To be determined

2:30 *Numerical Simulations of Buoyant Chemical Front Propagation in Hele-Shaw Flow*
Jingyi Zhu, University of Utah; Paul D. Ronney, University of Southern California

2:50 *Application of the Generalized Flame Stretch Concept in Laminar Premixed Flame Modeling*
L.P.H. de Goey, R. M. M. Mallens and J. H. M. ten Thije Boonkkamp, Eindhoven University of Technology, The Netherlands

CP14/Rosalie

Heterogeneous Combustion I

Chair: To be determined

2:30 *Three-Dimensional Chemical Vapor Deposition with Detailed Gas-Phase and Surface Chemistry*
Alexandre Ern, CER Mathematiques, ENPC, France; Vincent Giovangigli, Center de Mathematiques Appliquees, CNRS, France; and Mitchell D. Smooke, Yale University

2:50 *A 2D Code for Droplet Vaporization and Ignition with Detailed Chemistry*
Yamina Aouina, Uwe Riedel, and Ulrich Maas, Interdisciplinary Center for Scientific Computing, Germany and Jürgen Warnatz, Universitat Heidelberg

CP15/Ile de France II & III

Furnaces

Chair: To be determined

2:30 *Coal-fired Furnace Model for Real-time Simulation*
Bram de Jager, Eindhoven University of Technology, The Netherlands and Harry Anneveld, Stork Boilers, The Netherlands

CP16/Orleans

Detonation III

Chair: Joseph Shepherd, California Institute of Technology

2:30 *A Grid Refinement Study for Detonation Simulation with Detailed Chemistry*
Ulrich Uphoff, D. Hanel and P. Roth, Universität Duisburg, Germany

2:50 *Detonations Provoked by Gradients in Temperature or Concentration*
James J. Quirk, California Institute of Technology; *A.K. Kapila*, Rensselaer Polytechnic Institute

3:10-3:40

Coffee/Ile de France I

3:40-5:40 PM

Concurrent Sessions

MS5/Ile de France II & III

Numerical Methods for Premixed (Turbulent) Combustion Fronts: Design and Applicability

The extremely short length and time scales of premixed flames suggest numerical representation as reactive discontinuities. If the thickness of the flame brush is much smaller than a characteristic system dimension, the same approach holds for turbulent premixed combustion. This strategy requires (i) geometrical front representation including topological changes and (ii) numerical flame-flow coupling.

In this minisymposium, three speakers present different techniques based on level-set and/or volume of fluid ideas for the geometry problem and tracking and/or capturing methods for flame-flow coupling. These techniques are computationally efficient and reduce modelling to the specification of a turbulent burning velocity and jump conditions. However, they are not universally applicable. Multi-scale turbulence/mean flow/reaction-diffusion interactions may induce phenomena not expected form standard scaling analyses. Those effects may require drastic modifications of the "reactive front approaches". Two speakers will address the theoretical/numerical aspects of this issue.

Organizer: Rupert Klein
RWTH Aachen, Germany

3:40 ***Detonation Front Tracking — Combining Detonation Shock Dynamics and Level Set Technologies***
John B. Bdzil, Los Alamos National Laboratory; and D. Scott Stewart, University of Illinois, Urbana

4:10 ***Assessment of Numerical Methods for Direct Numerical Simulation of Combustion***
Stewart Cant, Cambridge University, United Kingdom

4:40 ***A Multi-Fluid Algorithm for Flame Propagation***
John B. Bell, Lawrence Livermore National Laboratory; *Phillip Colella*, University of California, Berkeley; Jeffrey A. Greenough and Daniel L. Marcus, Lawrence Livermore National Laboratory

5:10 ***Turbulent Combustion in the Large Scale Limit***
Pedro Embid and Andrew J. Majda, Princeton University

5:40 ***Large Eddy Simulation of Turbulent Premixed Flames using a Capturing/ Tacking Hybrid Approach***
Verena Moser, RWTH Aachen, Germany

MS6/Rosalie

Parallel Computation of Combustion Problems: New Algorithm and Applications

Realistic combustion problems are traditionaly very difficult to compute accurately because they exhibit multiple physical scales and strongly non-linear phenomena.

The best available numerical methods usually are adaptive in space and in time, and often work on irregular data sets. Because the elapsed time of computation is so large implicit schemes are often used.

On the contrary, Massively Parallel Platforms (MPPs) perform best on regular data structures with low order explicit schemes that require only local communications among processors. The best implementation of an explicit scheme with partitioning of a regular mesh a given MPP is not trivial to obtain. Irregular meshes are significantly more difficult to match well to an MPP architecture and implicit schemes may produce terrible communications bottle-necks.

The speakers in this minisymposium will discuss solution of realistic combustion problems with high order accuracy *and* high efficiency *on* very large MPP. *The presentations will focus on the design of* new numerical methods *for combustion problems that perform well on MPP and take care to describe the implementation procedure which may enhance significantly the performance of the code. MPPs force us to design new accurate and robust numerical method that optimize the access to data sets. Such improvements may benefit computation on other supercomputers.*

Organizer: Marc Garbey
Université Claude Bernard Lyon I, France

3:40 ***Striving Towards Realistic Simulations of Detonation Phenomena***
James Quirk, California Institute of Technology

4:10 ***Massively Parallel Computation of Stiff Propagating Combustion Fronts***
Marc Garbey, Organizer and Damien Tromeur-Dervout, University Claude Bernard Lyon 1, France

4:40 ***Parallel Direct Numerical Simulation of Turbulent Flames on MPP Systems***
D.R. Emerson, CLRC, United Kingdom

5:10 ***Shock/Cylinder Interactions by Parallel ENO on the CM5***
Carl Quillen, Brown University

MS7/Maurepas

Computational Modeling of Energetic Materials

The development of advanced propellants employing new nitramines requires a more sophisticated approach than the conventional methods of testing a matrix of ingredients to arrive at a formulation empirically. Such an approach is too costly and time consuming for the large matrix of nitramine/binder combinations. The development of a computational model to predict the regression rate as well as the temperature, heat release, and species concentrations in nitramine based systems, however, is extremely important to the propellant designer in the fabrication of more energetic and stable systems. In this minisymposium, the speakers focus on issues relating to the computational modeling of energetic materials with particular emphasis on model development, numerical algorithms and chemistry submodels.

Mitchell D. Smooke
Yale University

3:40 ***An Eigenvalue Method for Determining the Burning Rate of RDX Propellants***
Kuldeep Prasad, Naval Research Laboratory

4:10 ***Chemistry Models for Energetic Materials***
Richard Yetter, Princeton University

4:40 ***Title to be determined***
Tim Parr, Naval Weapons Center

5:10 ***Modeling Multidimensional Flames with Application to Energetic Materials***
Mitchell D. Smooke, Organizer

Orleans

Poster Session

Modeling of Premixed Flat H2/O2/Ar Flame Structure at High Pressures
T. A. Bol'shova, O. P. Korobeinichev, A. A. Paletsky, L. V. Kuibida, Institute of Chemical Kinetics and Combustion, Russia

Modelling Study of the Oxidation and Antiknock Effect of ETBE
F. Baronnet, CNRS, INPL-ENSIC, France; H. Bohm, Universitat Bielefeld, Germany; and B. El Kadi, Aluminium Pechiney, France

Influence of the Spray Modelling on the Diesel Engines Combustion and Pollutant Formation Numerical Predictions
P. Belardini, C. Bertoli and M. C. Cameretti, Universita degli Studi di Napoli 'Federico II', Italy

Numerical Modeling of Composite Propellant Combustion
Francesco Miccio, IRC-CNR, Napoli, Italy

Computer Aided Design of Gas-phase Oxidation Mechanisms and Application to the Modeling of Normal Butane Oxidation
V. Warth, F. Battin-LeClerc, N. Stef, L. Chevillard, R. Bounaceur, V. Michel-Bloch, P. Barbe, G. Scacchi and G.M. Come, Universite de Nancy, France

Tuesday (cont.)

Computational Simulation of Two Dimensional Laminar Diffusion Flames using Simplified Kinetics
F. Marsano, P.J. Bowen, N. Syred and T. O'Doherty, University of Wales, United Kingdom

Direct Numerical Simulation of a Supersonic Mixing Layer
Marc Massot and Vincent Giovangigli, CMAP-CNRS Ecole Polytechnique, France

Flamelet Based Analysis of Nonequilibrium Effects and No Formation in Turbulent Hydrogen Diffusion Flames
Hans Sanders and Iskender Gokalp, Centre National de la Recherche Scientifique, France

WEDNESDAY MORNING, MARCH 6

7:30/Ballroom Foyer

Registration opens

8:15/Ile de France II & III

Closing Remarks
Mitchell D. Smooke, Yale University

8:30/Ile de France II & III

IP5/Chair: A.K. Kapila, Rensselaer Polytechnique Institute

The Dynamics of Multi-Dimensional Detonation

We will review developments in the theory of the dynamics of multi-dimensional detonation derived from rational asymptotic analysis. Limits include: near-planar limits, near-Chapman-Jouget limits, small detonation shock curvature limits, and sensitive reaction-rate limits. Topics include: stability of detonation, the diameter effect, and intrinsic evolution shock evolution. Results that we obtained for Arrhenius kinetics with large, dimensionless activation energy, that predict pulsating and cellular detonation will be discussed. We also discuss numerical strategies to calculate the dynamics of the detonation front in complex geometries, that use intrinsic shock dynamics. Specifically, we consider Level-Set techniques and their application to explosive engineering design codes.

D. Scott Stewart
Department of Theoretical and Applied Mechanics, University of Illinois, Urbana-Champaign

9:30 AM-12:00 PM

Concurrent Sessions

with break at 10:10-10:40

CP17/Ile de France II & III

Flames III

Chair: Tadao Takeno, University of Nagoya, Japan

9:30 ***Formulation of a Model Problem Describing Premixed-Flame-Dynamics and Flow-Field Coupling***
R. C. Aldredge, University of California, Davis

9:50 ***Investigation of a Premixed Jet Flame at Near-Blowout Limit***
V. R. Katta, Innovative Scientific Solutions, Inc., Dayton, OH; and W. M. Roquemore, Wright Laboratory, Wright-Patterson AFB

10:40 ***Emission Benefits of Flickering Laminar Methane Flames***
Jeffrey Lienau and Chiang Shih, Florida State University

11:00 ***Using Unsteady and Nonuniform Flows to Alter Flame Chemistry***
David W. Mikolaitis and John Abbitt, University of Florida

11:20 ***Modulation of Fast Premixed Deflagrations***
Michael Booty, New Jersey Institute of Technology

11:40 ***Effects of Rotating Flow on Premixed Tubular Flame***
Makihito Nishioka and Tadao Takeno, Nagoya University, Japan

CP18/Rosalie

Heterogeneous Combustion II

Chair: Frank Behrendt, Universität Heidelberg, Germany

9:30 ***Flow Fluctuations and Coal Particle Behavior in Hot Furnace Atmosphere***
C. F. Bender and M. L. Mittal, Ohio Supercomputer Center; and R. H. Essenhigh, Ohio State University

9:50 ***Dynamics and Combustion of Gas-Particle Flows in Combustors***
E. Chang and *K. Kailasanath*, Naval Research Laboratory

10:40 ***The Devolatilization Process of a Coal Particle. A Theoretical Approach***
Boaz Zmiri, Mark Dulger and Eran Sher, Ben-Gurion University, Israel

11:00 ***Heterogeneous Combustion and the Evolution of Surface Phases***
Dirk Meinkohn, German Aerospace Research Establishment-DLR, Germany

11:20 ***Elliptic and Parabolic Model Comparison for Methane Oxidation over Heated Non-Catalytic/Catalytic Surface***
Hasan Karim, Lisa D. Pfefferle and Mitchell D. Smooke, Yale University; Penelope Markatou, Automated Analysis Corporation; and Yuenong Xu, Chemical Bank

11:40 ***Study of Heterogeneous Oxidation of CO at Platinum Using a Monte-Carlo Simulation***
Frank Behrendt and Jürgen Warnatz, Universitat Heidelberg, Germany

CP19/Maurepas

Turbulence III

Chair: Paul Ronney, University of Southern California

9:30 ***Conserved Scalar Statistics for Turbulent Diffusion Flames from Direct Numerical Simulations***
K. H. Luo and N. D. Sandham, Queen Mary and Westfield College, United Kingdom

9:50 ***Premixed Turbulent Flames in Channel Flow***
Tareg M. Al-shaalan and Christopher J. Rutland, University of Wisconsin-Madison

10:40 ***A Tree Method for Treating Chemical Reactions in PDF Calculations of Turbulent Combustion***
B. Yang, S. B. Pope, Cornell University

11:00 ***Large Eddy Simulations of Buoyant Plumes***
William E. Mell, Kevin B. McGrattan, Howard R. Baum and William M. Pitts, National Institute of Standards and Technology; Art W. Johnson, GE Aircraft Engines, Cincinnati

11:20 ***Application of a Realizable Second-Moment Closure to Turbulent Reacting Flows***
D. Lentini, Università degli Studi di Roma, Italy

11:40 ***Kinetic Coefficients Calculation in Reacting Gases and Modelling of Turbulent Flow***
Boris V. Alexeev, Moscow Fine Chemical Technology Institute, Russia; Alexandre I. Fedoseyev, and J. Iwan D. Alexander, University of Alabama, Huntsville

CP20/Orleans

Numerical Techniques IV

Chair: Thomas Hagstrom, University of New Mexico

9:30 ***Calculation of Reacting Flows Using Solution-Adaptive Unstructured Mesh on Parallel Architectures***
T. L. Tysinger and M. Missaghi, Fluent Inc., Lebanon, NH

9:50 ***Parallel Computation and Implicit Multigrid Methods for NO_x Prediction in 3-D Turbulent Diffusion Flames***
Changming Liao, Xiaoqing Zheng, Zhining Liu and Chaoqun Liu, University of Colorado, Denver

10:40 ***A High-Order Numerical Method for Flame Simulations with Complex Models***
Thomas Hagstrom, University of New Mexico, Albuquerque; Krishnan Radhakrishnan, NYMA, Inc. NASA Lewis Research Center, Cleveland

11:00 ***Investigation of Turbulent Diffusion Flames Using Parallel Computers***
Dominique Thevenin, Sebastien Candel, Ecole Centrale Paris, France

11:20 ***Parallel Iterative Methods for Steady-State Combustion Modeling***
Glen A. Hansen, Idaho National Engineering Laboratory; *David E. Keyes*, Old Dominion University; Dana A. Knoll and Paul R. McHugh, Idaho National Engineering Laboratory

11:40 ***Numerical Modeling of Laminar Premixed Flames by Boundary-Domain Integral Method***
N. Samec and L. Skerget, University of Maribor, Slovenia

WEDNESDAY AFTERNOON, MARCH 6

12:00-1:30

Lunch

1:30/Ile de France II & III

IP6/Chair: To be determined

Numerical Simulation of Premixed Flame Propagation in a Closed Vessel

Premixed flame propagation in a closed vessel is a basic phenomenon for understanding an internal combustion problem. We present this phenomenon through a direct numerical simulation of the three-dimensional unsteady Navier-Stokes equations coupled with chemical reactions. In order to cope with a low speed combustion flow problem, we employ an extended version of the MAC method as a numerical scheme. This method can be applied to a compressible flow with strong density variation. In this simulation, we reproduce a formation of a tulip flame, which is one of representative phenomena with respect to flame instabilities, and show a flame transformation process using an unsteady three-dimensional visualization system. (Co-author: Kazuto Kuzuu, Institute of Computational Fluid Dynamics, Japan.)

Kunio Kuwahara
The Institute of Space and Astronautical Science, Japan

2:15-2:45

Coffee/Ile de France I

2:45-4:45 PM

Concurrent Sessions

CP21/Ile de France II & III

Theory/Modeling

Chair: Pedro Embid, Princeton University

2:45 ***Diffusive and Anti-Diffusive Propagation of a Flame-Front Near Stoichiometry***
J.W. Dold, UMIST, United Kingdom; and D.G. Crighton, University of Cambridge, United Kingdom

3:05 ***Linear Stability of Oblique Waves***
Hyoung-In Lee, Samsung Advanced Institute of Technology, Korea

3:25 ***Coupling of Molecular Transport, Radiation Transport and Chemical Kinetics with Gas Flow in Investigation of Space Probe Combustion in Atmosphere of Jupiter***
G.A. Pavlov, Institute of Chemical Physics of RAS, Russia; and A. A. Shiriaev, Institute of Structural Macrokinetics of RAS, Russia

3:45 ***Thermodiffusion Instability in the Fuel Element***
G.A. Pavlov, Institute of Chemical Physics of RAS, Russia; and A. A. Shiriaev, Institute of Structural Macrokinetics of RAS, Russia

4:05 ***Numerical Analysis of Superadiabatic Combustion***
Gennady A. Fateev, Academy of Sciences of Belarus, Belarus

4:25 ***Modeling of Filtration Gas Combustion in a Porous Medium with a Discrete Periodic Structure***
Oscar S. Rabinovich and Alexander V. Fefelov, Academy of Sciences of Belarus, Belarus

CP22/Rosalie

Ignition/Heterogeneous/Miscellaneous

Chair: To be determined

2:45 ***Homogeneous-Heterogeneous Ignitions and Extinctions of Hydrogen/Air Mixtures***
Dionisios G. Vlachos, University of Massachusetts, Amherst

3:05 ***Fuel Atomization by Flashing a Theoretical Approach***
Michal Zeigerson-Katz and Eran Sher, Ben-Gurion University of the Negev, Israel

3:25 ***Modeling Fluctuations of Particulate Processes During Combustion***
Wei-Yin Chen, University of Mississippi; and L.T. Fan, Kansas State University

CP23/Maurepas

Turbulence IV

Chair: Bernd Rogg, Ruhr Universitat, Germany

2:45 ***The Euclidean Minimum Spanning Tree (EMST) Model for Scalar Mixing in the PDF Approach to Turbulent Combustion***
Shankar Subramaniam and S. B. Pope, Cornell University

3:05 ***Buoyancy Effects on the Structure of Turbulence in Nonpremixed Flames***
Olus Boratav, Said Elghobashi and Rongbing Zhong, University of California, Irvine

3:25 ***Extinction at Transition Point from Laminar to Turbulent Jet Diffusion Flames***
Hiroshi Yamashita, Masafumi Shimada and Tadao Takeno, Nagoya University, Japan

3:45 ***PDF Modelling and Numerical Simulation of Autoignition of a Turbulent Spray Jet***
M. Zhu and K.N.C. Bray, University of Cambridge, United Kingdom; *B. Rogg*, Ruhr-Universitaet Bochum, Germany

CP24/Orleans

Propellants/Algorithms

Chair: Steven Son, Los Alamos National Laboratory

2:45 ***Numerical Modeling of Coupled Heat-Mechanical and Gas-Dynamical Processes in Erosive Solid Propellants***
Yury I. Dimitrienko, R&D Corporation "NPO Mashinostroenia" Russia

3:05 ***The Role of Secondary Waves in Combustion of Porous Propellants***
Irina D. Dimitrienko and Nickolay N. Smirnov, Moscow State University, Russia

3:25 ***Stiff Method of Lines for Problems of Continuous Media***
N. N. Kalitkin, Institute for Mathematical Modelling, Russia

3:45 ***A New Hydrodynamics Model for Study Internal Flows***
I.A. Sokolova, Institute for Mathematical Modeling, Russian Academy of Sciences, Russia; and B. V. Rogov, Institute of High Temperature, Russian Academy of Sciences, Russia

4:05 ***Computational Model for Premixed Burning Flows through Variable Cross Section Channel***
B.V. Rogov, Institute of High Temperature, Russian Academy of Sciences, Russia; I. A. Sokolova, Institute for Mathematical Modeling, Russian Academy of Sciences, Russia

4:25 ***Numerical Algorithms on Moving Adaptive Meshes***
S. V. Utyuzhnikov, D. H. Gan'zha and V. V. Polukhin, Moscow Institute of Physics & Technology, Russia

4:45

Conference Adjourns

SPEAKER INDEX

CP = Contributed Presentation
IP = Invited Plenary
MS = Minisymposium
PS = Poster Session

HOTEL INFORMATION

Le Meridien Hotel

614 Canal Street
New Orleans, LA 70130
Telephone: 504-525-6500
Fax: 504-525-8068

SIAM is holding a block of rooms at Le Meridien Hotel. These rooms are being held on a first come, first served basis at $125.00 single or $145.00 double room. These rooms will be held for our exclusive use only until Thursday, **February 1, 1996**. Reservations made after February 1 will depend on availability.

We urge you to make your reservations as soon as possible. You may do so by calling Le Meridien, faxing your reservation, or mailing in the Hotel Reservation Form located on the back of this program. When making your reservation via phone, please be certain to identify yourself as an attendee at the SIAM Conference on Numerical Combustion to receive the discounted rate.

Location: The Le Meridien Hotel is located in the central business district adjacent to the French Quarters and Canal Street where a variety of shops abound. It is an easy walking distance to the New Orleans Superdome and St. Charles Avenue where you will see the New Orleans Casino and various Mississippi River attractions.

Deposit: The Le Meridien requires a deposit equivalent to one night's room rate to guarantee your reservation. The hotel accepts AMEX, MC, Visa, Diner's Club, or personal checks as payment.

Arrivals and Departures: Check-in time is 3:00 PM and check-out time is 12:00 Noon.

Cancellations: If you need to change or cancel your reservation, you must contact the hotel by 1:00 PM Central Time on your stated date of arrival to avoid any unnecessary charges.

Dining: Le Meridien has two restaurants. The La Gauloise – a bistro type restaurant, and the Louis Armstrong Foundation Jazz Club – a Jazz Lobby Bar.

Recreational Facilities: The hotel has a fully equipped Fitness Center, a heated outdoor swimming pool, sauna, locker rooms, massage clinic, aerobic room, and VCR aerobic classes. The hotel provides complimentary workout clothes to its guests. Golf and tennis are available within ten minutes upon arrangements with the hotel concierge. Deep sea fishing, horseback riding, swamp tours, city tours, plantation tours, and paddle-wheel steamboat cruises are also available upon prior arrangements through the concierge.

Parking: Self parking is available in the hotel garage at a cost of $12.00 per day with unlimited in and out privileges. Attendees not staying in the hotel can park at a cost of $12.00 for 3-12 hours. The garage is located on Common Street which is one block off of Canal Street.

TRANSPORTATION INFORMATION

By Air

Official Carrier for Continental USA and Canada

SIAM has selected American Airlines as the official carrier for this conference. Discounts are available to conference attendees from March 1 - 9, 1996.

By flying American Airlines you become eligible for the following discounts:

- 5% off the Supersaver Fares (21 day advance purchase with a Saturday night stayover)
- 10% off Standard Coach Fares (7 day advance purchase with no Saturday night stayover)

SIAM has selected Get-A-Way Travel agency to assist attendees in making travel arrangements. Get-A-Way Travel will make your reservations on American Airlines or any airline of your choice. To take advantage of the American Airlines discounts, you must book your reservation through Get-A-Way Travel by calling 800-223-3863 or 215-379-6800. Ask for Carol Brecht. Be sure to mention that you are attending the 1996 SIAM Conference on Combustion. Get-A-Way Travel will issue your tickets and mail them to you.

Airport Transportation

New Orleans is easy to get to and around! Commercial shuttle bus service is available through Airport Shuttle which picks up at the airport every 10 minutes outside the baggage claim areas. You can purchase your tickets directly from the van drivers. The cost is approximately $8.00 one way. A cab fare is approximately $20.00 each way.

Driving Directions to the Le Meridien Hotel from the airport. Take I-10 West to the downtown area. Take Poydra Exit (Superdome) 9 blocks to Camp Street. Make a left at Camp Street and go 2 blocks to Common Street. The Hotel is on the right off of Common Street.

REGISTRATION INFORMATION

The registration desk is at the entrance of the Foyer area of the Ile De France Ballroom. The registration desk will be open as listed below:

Sunday, March 3	**5:00 PM - 7:00 PM**
Monday, March 4	**7:00 AM - 4:00 PM**
Tuesday, March 5	**7:30 AM - 4:00 PM**
Wednesday, March 6	**7:30 AM - 3:00 PM**

REGISTRATION FEES

Preregistration deadline: Tuesday, February 20, 1996.

	INRIA/SIAM Member	Non-Member	Student
Before 2/20/96	$195	$225	$35
After 2/20/96	$235	$265	$35

Registration fees will include:

- Admission to all of the technical sessions for three days.
- Morning and afternoon coffee breaks.
- Welcoming Reception.
- A book of extended abstracts (available only at the conference).

To register, complete the Preregistration Form in the back of this program and return it with your payment to SIAM. You can also register in the following ways:

- Telephone: 215-382-9800;
  Toll free-800-447-7426 (USA only).
- E-mail: *meetings@siam.org*
- Fax: 215-386-7999
- WWW: *http://www.siam.org/meetings/co96/co96home.htm*

We urge attendees to preregister and save! To qualify for the preregistration fee, return this Preregistration Form with payment to the SIAM Office by Tuesday, February 20, 1996.

Preregistrations received at the SIAM office after Tuesday, February 20 will be subject to the difference between the preregistration and the registration fees ($40). This amount will be charged to your credit card or collected from you at the conference.

There will be no prorated fees. Refunds will not be issued after Friday, March 1, 1996.

NON-SIAM MEMBERS

Non-member registrants are encouraged to join SIAM to take advantage of the difference between member and non-member registration fees, and enjoy all the other benefits of SIAM membership. As a member, you will receive free subscriptions to *SIAM Review* and *SIAM News*, and substantial discounts on SIAM books and journal subscriptions. We invite you to join SIAM now! Contact SIAM Customer Service for an application form at telephone: 215-382-9800 or 800-447-SIAM (toll free U.S. only), fax: 215-386-7999; E-Mail: service@siam.org. or mail to SIAM, 3600 University City Science Center, Philadelphia, PA 19104-2688. You may also fill out an application through SIAM's World Wide Web homepage (***http://www.siam.org***) and return it electronically. Upon receipt of your membership dues and preregistration fee, you will be registered as a SIAM member. You save $30 in your registration.

CANCELLATION POLICY

Cancellation prior to: February 20, 1996	Full refund
February 21 - March 1, 1996	$25.00 Cancellation Fee
After March 1, 1996	No Refund

CREDIT CARDS

SIAM accepts VISA, MasterCard and American Express. Please indicate credit card type, account number and the expiration date on the Preregistration Form.

SIAM Corporate Members

Non-member attendees employed by the following institutions are entitled to the SIAM member registration fees.

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National Security Agency
NEC Research Institute
Supercomputing Research Center, a Division of Institute for Defense Analyses
United Technologies Corporation
Visual Numerics, Inc.

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The telephone number of the Le Meridien Hotel is 504-525-6500. The Meridien will either connect you with the SIAM registration desk or forward a message to the attendee's room.

Hotel Roommate-Sharing Database

SIAM will keep a database of attendees who may wish to share a room with another attendee at the conference to cut down on expenses. Forward the following information via e-mail to: tmp@siam.org or by fax: 215-386-7999 to be placed on the database. BE SURE TO MENTION THAT YOU ARE INTERESTED IN THE COMBUSTION CONFERENCE DATABASE.

Name
Address
Phone, Fax and E-mail
Gender
Smoker or Non-Smoker
Arrival and Departure Dates
"COMBUSTION CONFERENCE DATABASE"

It is the responsibility of the attendee to make the contacts and arrangements with attendees on the database.

Sixth International Conference on Numerical Combustion

March 4 - 6, 1996 • Le Meridien New Orleans Hotel • New Orleans, Louisiana

Conducted by SIAM with the cooperation of Institute National de Recherche en Informatique et en Automatique (INRIA)

HOTEL RESERVATION FORM

SIAM is holding specially discounted rooms for our exclusive use until Thursday, February 1, 1996. After that date, reservations will depend on availability. Your reservation is not confirmed until acknowledged in writing by the hotel or verified by phone. Include a deposit in the amount of one night's room rate to confirm your reservation. When making reservations by phone, be certain to identify yourself as an attendee at the SIAM Conference on Combustion. The Meridien Hotel telephone: 504-525-6500 or fax: 504-525-8068.

Please send me a confirmation

Please Print

Name _____

Address _____

City _____ State _____ Zip _____

Phone _____

Please reserve a ☐ $125/Single ☐ $145/Double

Arrival Date _____ Arrival Time _____ Departure Date _____

☐ I am a disabled participant and require appropriate accommodations

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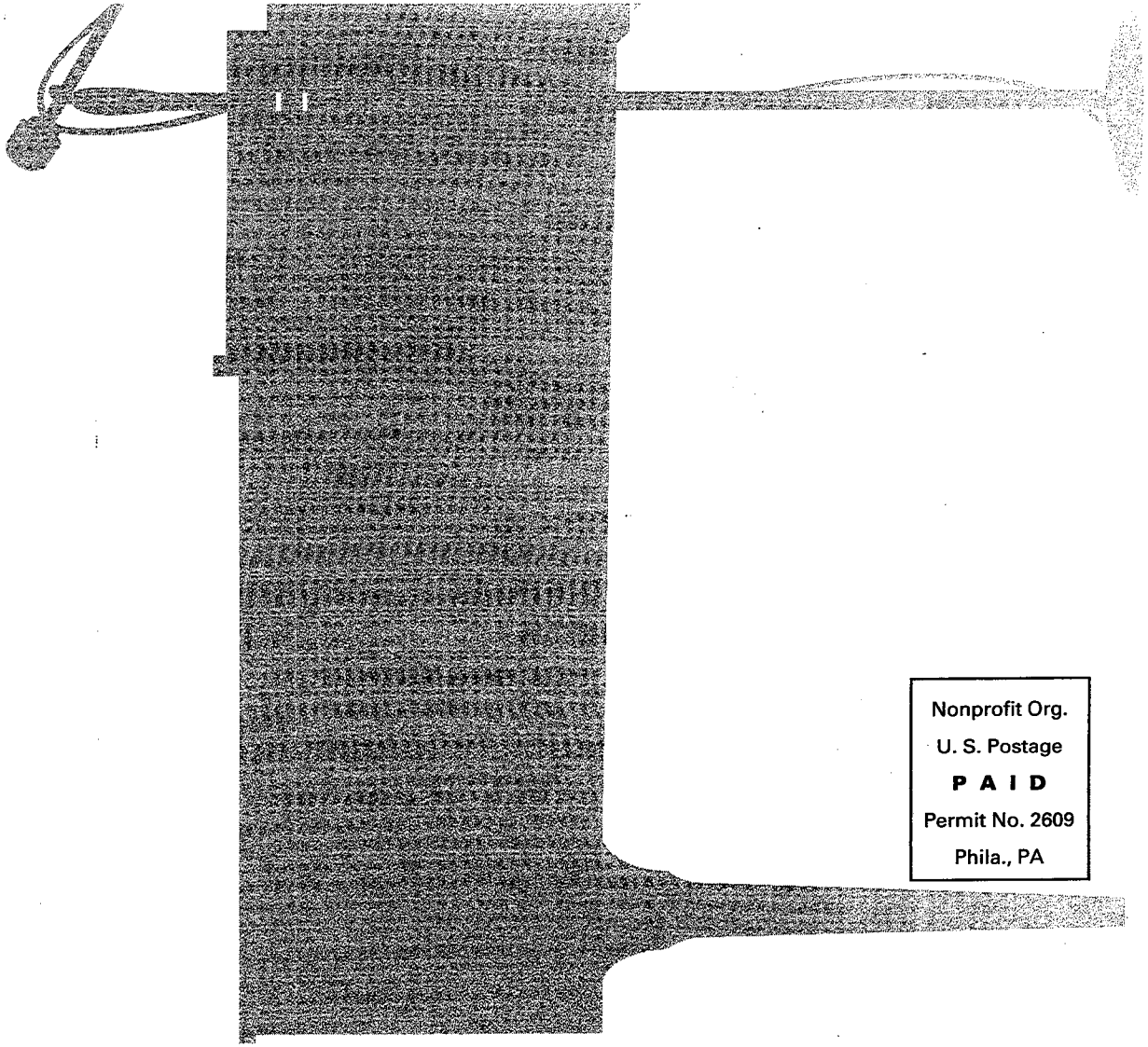

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