

# Final Program

Final symposium program is available (updated!). Click here to download the PDF version.

Â SUNDAY, AUGUST 9, 2009

15.00 – 18.00

Registration Â

19.00 – 20.00

Welcome Reception Â MONDAY, AUGUST 10, 2009

08.00 – 08.50

Registration Â

08.50 – 09.00

Opening Â

09.00 – 10.20 Session 1 Chair: R. J. GOLDSTEIN Â

Keynote Turbine Airfoil Leading Edge Aerodynamics and Heat Transfer – A Review

Lee S. LANGSTON, Brian M. HOLLEY Â

Keynote Recent Progress in Numerical Simulation of Highly Three-Dimensional Turbulent Flows and Endwall Heat Transfer in Turbine Blade Cascades

Evgueni M. SMIRNOV Â

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10.20 – 10.40

Coffee Break Â

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10.40 – 13.00 Session 2 Chair: T. W. SIMON Â

18-TE Experimental Investigation of Turning Flow Effects on Innovative Trailing Edge Cooling Configurations with Elliptic Pin Fins

Carlo CARCASI, Francesco SIMONETTI Â

33-THT Heat Transfer Characteristics on Tip and Inner Rim Surfaces of Rotor Blade with Squealer Rim

Jun Su PARK, Dong Hyun LEE, Woo Jin LEE, Hyung Hee CHO, Dong-Ho RHEE, ShinHyung KANG Â

38-THT Advanced Aero-thermal Investigation of High Pressure Turbine Tip Flows

P ter VASS, Tony ARTS Â

42-TE Trailing Edge Film Cooling of Gas Turbine Airfoils – Effects of Ejection Lip Geometry on Film Cooling Effectiveness and Heat Transfer

Tim HORBACH, Achmed SCHULZ, Hans-Joerg BAUER Â

52-THT Augmented Heat Transfer of an Internal Blade Tip by Full or Partial Arrays of Pin-fins

Gongnan XIE, Bengt SUNDEN, Lieke WANG, Esa UTRAINIEN

62-THT Flow and Heat Transfer on and near a Transonic Turbine Blade Tip

Qiang ZHANG, Devin DOWD, Phillip LIGRANI, Li HE, Andrew WHEELER

22-JI Effects of Mach Number, Reynolds Number, and Jet Spacing on Surface Heat Transfer for a Full Array of Impinging Jets

Matt GOODRO, Phil LIGRANI, Mike FOX, Hee-Koo MOON

13.00 – 15.00

Break

15.00 – 17.00 Session 3 Chair: A. I. LEONTIEV

Keynote Turbine Airfoil Aerothermal Characteristics in Future Coal-Gas Based Power Generation Systems

Minking K. CHYU, Mary Anne ALVIN

32-COMB Thermal-mechanical Life Prediction in After Shell Section of Gas Turbine Combustion Liner

Kyung Min KIM, Yun Heung JEON, Namgeon YUN, Dong Hyun LEE, Hyung Hee CHO

68-COMB Coupling Study between heat Transfer and Aerodynamic Flow in Square-edged Inlet

Phu Hung NGUYEN, Viet Hung NGUYEN, Eva DORIGNAC

60-COMB Heat Transfer Investigation of the Sub- and Supercritical Fuel Flow through a U-turn Tube

C. B. ZHANG, Z. TAO, G. Q. XU, H. W. DENG, J. N. SUN

17.00 – 17.20

Coffee Break

17.20 – 18.40 Session 4 Chair: B.V.S.S.S. PRASAD

11-SA Calculation of Gas Turbine Blade Temperatures Using an Iterative Conjugate Heat Transfer Approach

Mangesh KANE, Savas YAVUZKURT

43-FC Effect of Internal Rib Configurations on the Discharge Coefficient of a 30-deg Inclined Film Cooling Hole

Christian HENEKA, Achmed SCHULZ, Hans-Joerg BAUER

61-FC Influence of Internal Cyclone Flow on Adiabatic Film Cooling Effectiveness

Andreas LERCH, Heinz-Peter SCHIFFER

69-FC Study on the Thermal and Flow Fields of Film Cooling with Shaped Film Cooling Holes

Kenichiro TAKEISHI, Satoshi HADA, Shohei MORI, Masaharu KOMIYAMA

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Â Â TUESDAY, AUGUST 11, 2009

09.00 – 10.20 Session 5 Chair: H.-P. SCHIFFER Â

Keynote Film Cooling: Breaking the Limits of Diffusion Shaped Holes

Ron S. BUNKER Â

Keynote Experimental determination of the aero-thermal performance of high pressure gas turbine blades

Tony ARTS Â Â Â

10.20 – 11.00 Coffee Break & Posters Â

8-COMB Experimental Study of Equivalence Ratio Influence on Thermoacoustic Instability in Gas Turbines Â

Nasser Seraj MEHDIZADEH, Nozar AKBARI, Reza EBRAHIMI Â

35-COMB Analytical and Experimental Analysis of Reactants Velocity Effect on Instability of Premixed Combustion Chamber Â

Nasser SERAJ MEHDIZADEH, Nozar AKBARI, Reza EBRAHIMI

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23-FC A Comparative Study of the Film Cooling Hole Configuration Effects on the Leading Edge of Asymmetrical Turbine Blade

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Mustapha BENABED, Abbas AZZL, B. A JUBRAN Â

28-FC Comparison Study of Closure Models for Modeling a Flow on Curved and Flat Plates. Film Cooling of Gas Turbine Blade Application Â

R. DIZENE, A. BERKACHE, S. BENMANSOUR Â

29-FC First Moment Closure Modeling of Film Cooling Effectiveness in Single Row of Cylindrical Holes Â

Farzad BAZDIDI-TEHRANI, Hosein FOROUTAN, Mehran RAJABI-ZARGARABADI Â

27-EFHT Front Bulkhead Upstream Flow Effect on the Inlet Guide Vanes of MS5002B Gas Turbine Compressor Â

D. CHERKERKER, Rabah DIZENE Â

30-EFHT Modeling of Heat Transfer in Exhaust Nozzle of Gas Turbines Â

Äzge ALTUN, Y. Erhan BÄKE Â

3-SA

A New Unsteady Fluid Network Approach to Simulate the Characteristics of the Air System of a Gas Turbine System Â

Shengping HOU, Zhi TAO, Shuiting DING Â

40-SA Optimization of a Gas Turbine Stator Nozzle Cooling Using Genetic Algorithms Â

Biagio MORRONE, Andrea UNICH, Antonio MARIANI, Vincenzo de MAIO Â

65-EW Effects of Stator/rotor Leakage Flow and Axisymmetric Contouring on Endwall Adiabatic Effectiveness Â

Ryan ERICKSON, Terrence W. SIMON Â

66-EW Effects of Wheelspace Coolant Injection and Gap Geometry on Blade Endwall Heat/Mass Transfer

Marco PAPA, V. SRINIVASAN, R. J. GOLDSTEIN, Fabio GORI  
 39-P Impact of the Geometry on the Improvement of the Thermal Transfer of the Turbulent Flows  
 Ahmed Zineddine DELLIL, Abbas AZZI  
 54-SACombined Heat Exchange Intensification Techniques as a Key to Development of Automotive  
 Anatoly V. SUDAREVA  
 59-CHFT PIV Measurements of the Flow in a Rotating Cavity with a Radial Inflow  
 Yu XIAO, X. LUO, G. Q. XU, J. N. SUN

53-EW Optimization of a Turbine Vane Endwall Using a Combined Natural and Numerical Approach

S.O. NEUMANN, H. STEINBRÄCK, S. ZEHNER, B. WEIGAND

11.00 – 12.20 Session 6 Chair: A. I. KIRILLOV

6-FC Study on Influence of Initial Wall Temperature Distribution on the Transient Measurement Results of Film Cooling

Cun-liang LIU, Hui-ren ZHU, Jiang-tao BAI, Du-chun XU

10-FC Comparison of Film Cooling in the Presence of Various Mainstream Pressure Gradients

Cun-liang LIU, Hui-ren ZHU, Guang-Chao LI, Du-chun XU

16-FC A Correlation-based Methodology to Predict the Flow Structure of Flows Emanating from Cylindrical Holes with Application to Film Cooling

Tilman auf dem KAMPE, Stefan VÄLKER

25-FC Effect of the Geometry of Film Cooling Holes on Heat Transfer Coefficient in Condition of Various Mainstream Pressure Gradients

Xiao-wei ZHANG, Hui-ren ZHU, Guang-Chao LI, Du-chun XU

12.20 – 15.00

Break

15.00 – 17.00 Session 7 Chair: K. TAKEISHI

Keynote Film Cooling Simulation and Control

Sumanta ACHARYA

12-EFHT Turbine Vane Cascade Heat Transfer Predictions Using a Modified Version of the  $\hat{P}^3$  Re $_{\tau}$  Laminar-Turbulent Transition Model

Evgueni SMIRNOV, Alexander SMIRNOVSKY

26-CHFT Large Eddy Simulation of Non-isothermal Flow in Rotor/stator Cavity

Ewa TULISZKA-SZNITKO, Artur ZIELINSKI, Wojciech MAJCHROWSKI

63-SA Comparison of Counter Rotating and Traditional Axial Aircraft Low-pressure Turbines Integral and Detailed Performances

Leonid MOROZ, Petr PAGUR, Yuri GOVORUSCCHENKO, Kirill GREBENNIK

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17.00 – 17.20

Coffee Break Â

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17.20 – 18.20 Session 8 Chair: P. LIGRANI Â

9-EW Numerical Simulation of the Endwall Heat Transfer in the Langston Cascade

Alexander M. LEVCHENYA, Evgueni M. SMIRNOV, Dmitry ZAYTSEV Â

44-EW An Experimental Study of Airfoil and Endwall Heat Transfer in a Linear Turbine Blade Cascade – Secondary Flow and Surface Roughness Effects

Marco LORENZ, Achmed SCHULZ, Hans-Jörg BAUER Â

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20.00 – 23.00

Gala Dinner Â Â Â Â WEDNESDAY, AUGUST 12, 2009

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09.00 – 10.40 Session 9 Chair: A. SCHULZ Â

Keynote Heat Transfer Testing in Engine Turbine Cooling System Development

Peter IRELAND Â

17-IFHT Predicting the Coolant Flow and Heat Transfer in Radial Turbine Blades

Aidin PANAHI, Mozzafar Ali MEHRABIAN Â

21-IFHT Effect of Rotation to the Cyclone Cooling Method Mass Transfer Measurements

Nils WINTER, Martin KEGALJ, Heinz-Peter SCHIFFER

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10.40 – 11.00

Coffee Break

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11.00 – 12.00 Session 10 Chair: T. W. SIMON Â

## Â The Role of Gas Turbines in Global Energy Conversion

Lee S. Langston Â

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12.00 -

End of Day Â Â Â Â THURSDAY, AUGUST 12, 2009

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09.00 - 10.20 Session 11 Chair: E. DORIGNAC Â

Keynote Recent Studies in Turbine Blade Internal Cooling

Je-Chin HAN, Mike HUH Â

Keynote Multiple Jet Impingement - A Review

Bernhard WEIGAND, Sebastian SPRING Â

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10.20 - 10.40

Coffee Break Â

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10.40 - 13.00 Session 12 Chair: F. MARTELLI Â

7-JI Influence of Height to Diameter Ratio on Impingement Heat Transfer on Effused Concave Surface

M. Ashok KUMAR, B.V.S.S.S. PRASAD Â

19-JI Experimental Study of Heat Transfer from Impinging Jet with Upstream and Downstream Crossflow

Daniel THIBAUT, Matthieu FENOT, Gildas LALIZEL, Eva DORIGNAC Â

41-JI An Experimental and Numerical Investigation of Impingement Heat Transfer in Airfoils Leading-edge Cooling Channel

M. E. TASLIM, A. ABDELRAOUL Â

34-IFHT Liquid Crystal Thermography for Transient Heat Transfer Measurements in Complex Internal Cooling Systems

Rico POSER, Jens von WOLFERSDORF Â

47-JI Experimental (by tlc Method) and Theoretical Analyse of Heat Transfer Characteristics on a Rectangular Cross-section Duct with Impingement Jet

Unal UYSAL, Fatih SAHIN, M. K. CHYU Â

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13.00 - 15.00

Break Â

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15.00 – 17.00 Session 13 Chair: J.-Chin HAN Â

Keynote Experimental Turbine Aero-Heat Transfer Studies in Rotating Research Facilities

Cengiz CAMCI Â

56-FC Mixing of Air and CO<sub>2</sub> Study on a Turbine Blade

Yavuz Hakan ZDEMIR, Seyfettin BAYRAKTAR, Tamer YILMAZ Â

57-FC Investigation of Film Cooled Rough Surfaces Using Large Eddy Simulation

Prasad KALGHATGI, Sumanta ACHARYA Â

64-FC The Effect of Embedded Vortices on Film Cooling with Compound Angle Orientations

Hyo Kyung CHUNG, Young-Su NA, Joon Sik LEE Â

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17.00 – 17.20

Coffee Break Â

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17.20- 19.00 Session 14 Chair: L. S. LANGSTON Â

36-SA A Novel Method for the Computation of Conjugate Heat Transfer with Coupled Solvers

Tom VERSTRAETE, Rene Van den BRAEMBUSSCHE Â

48-SA Application of Artificial Neural Network (ANN) Method to Exergetic Analyses of Gas Turbines

Yilmaz YORU, T. Hikmet KARAKOC, Arif HEPBASLI Â

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19.00 - 19.10

Closing Remarks Â

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