The 30th International Symposium on Shock Waves (ISSW30) was held in Tel Aviv, Israel, during July 19–24, 2015. This was the 30th meeting in a series of symposia that started in Boston in 1957 (then under the name International Symposium on Shock Tubes). These symposia are held biennially in different countries in which active shock wave research is practiced. It is a central event for people active in different fields, such as physics, chemistry, fluid mechanics, gas dynamics, and applied mathematics, who are interested in shock wave-related phenomena. It was last held in Jerusalem, Israel, in 1979. The ISSW30 was held in Tel Aviv Dan Panorama Hotel. When comparing the topics and content of early symposia with the present one, one notices the significant developments that took place in the shock wave research. Hopefully these developments will continue.

A total of 370 abstracts were submitted for review by the deadline for abstracts submission. All submissions were reviewed by at least two members of the International Advisory Committee regarding standard and suitability for inclusion in the program. Out of the 370 submitted abstracts, 358 were accepted for either oral (314) or poster (44) presentations: 88 out of the 314 accepted abstracts for oral presentations and 8 out of the 44 accepted abstracts for poster presentations were submitted by graduate students. Unfortunately, by the time the meeting started 121 accepted papers were withdrawn (almost half of them from Russia, China, and India). The main reasons were lack of travel funds, security fears, and lack of clearance. Hence, the final program included 210 oral presentations and 27 poster presentations: 54 out of the 210 accepted abstracts for oral presentations and 4 out of the 27 accepted abstracts for poster presentations were presented by graduate students who competed on 12 student awards of 250 USD each that were donated by the International Shock Wave Institute (ISWI). The total number of the participants was about 300. In addition, there were 35 accompanying persons from overseas.

In summary, 9 invited presentations and 237 peer-reviewed contributed papers were presented. The Paul Vielle Memorial Lecture was delivered by Prof. Beric Skews on July 20, 2015, and the Irvine Israel Glass Memorial Lecture was delivered by Charles Needham on July 24, 2015. The other plenary lecturers were Prof. Riccardo Bonaza, Prof. Martin Brouillette, Prof. Ron Hanson, Prof. Achim Loske, Prof. Kazuo Maeno, Prof. Marcello Onofri, and Prof. K.P.J. Reddy.

The scientific program was complemented by three social events:

On the eve of the first day of the conference, a Welcome Gathering Cocktail, which included a full dinner, was held.

On the third day of the conference, only morning sessions were held; thereafter two different tours to attractive sites in Israel were offered. Participants and their accompanying persons could choose between a guided tour in Jerusalem and visit to various sites in the Galilee.

• The first option, the Jerusalem tour, included a visit to the Mount of Olives for a panoramic view of the city, a stop at Mount Zion to visit King David’s tomb, the room of last supper, and the Dormition Abbey, and thereafter entering the old city and walking through the
Armenian and Jewish quarters to the recently excavated and restored Cardo, the main Roman road, and then proceeding to the Jewish Wailing Wall and continuing to the Christian Quarter. The next sightseeing was a walk along the Via Dolorosa and visiting the Church of the Holy Sepulcher. The last stop of this tour was entering the Tower of David to view the spectacular Sound and Light show there. Ending this long tour was a dinner at a restaurant viewing the Old City walls.

- The second option, the Galilee tour, started with a drive along the coastal plain to Caesarea, capital of Judea under the Roman occupation, seeing there the excavations of the Crusader city and the Roman port, aqueduct, and the amphitheater that has been restored to its former glory as a concert venue. The next stop was the biblical city Megiddo, identified as the site of Armageddon, visiting the archaeological excavations including the well-preserved water supply system, and thereafter driving to Haifa, the largest harbor of Israel, with a breathtaking panoramic view of Haifa Bay and the Western Galilee from the summit of Mount Carmel and a walking tour of the German Colony, and then continuing to Daliat El Carmel, and visiting this pictorial Druze village and finally ending with a dinner at the house of a local Druze family.

The third social activity, for all participants, was the banquet dinner. It was held in Beit Guvrin, an underground “city” where Jews were hiding from the conquering Roman legions 2000 years ago. The dinner was held in a huge cave whose ceiling collapsed.

In addition to the above mentioned three social events, three tours were held to the accompanying persons: to the Galilee; to Masada and Dead Sea; and to Haifa, Acre, and Rosh Hanikra.

The International Advisory Committee (IAC) decided during its meeting that ISSW32 in 2019 will be held in Singapore. The IAC also decided to add to the Paul Vielle and the Irvine Israel Glass Memorial Lectures a third memorial lecture, the Ray Stalker Memorial Lecture.

As decided by the IAC during ISSW29, the 31st International Symposium on Shock Waves (ISSW31) will be chaired by Prof. Akihiro Sasoh, in Nagoya, Japan, in July 2017.

Beer Sheva, Israel

Gabi Ben-Dor
Oren Sadot
Ozer Igra
Contents

Part XII Plasma and Magnetohydrodynamics

K.K.N. Anbuselvan and K.P.J. Reddy

Pulse Gas Injection in Separation Zone of Hypersonic MHD Flow Over Rotation Body ...................................... 795
E. Gubanov, A. Likhachev, and S. Medin

Observations of the Magnetized Disruption of Collimated Plasma Flows .................................................. 801
Mario Manuel, Carolyn Kuranz, Alex Rasmus, Sallee Klein,
Michael MacDonald, Matt Trantham, Jeff Fein, Pat Belancourt,
Rachel Young, Paul Keiter, R.P. Drake, Brad Pollock, Jaebum Park,
Andrew Hazi, Jackson Williams, and Hui Chen

Shock-Wave Formation by Nanosecond Multichannel Surface Discharges .................................................... 803
A.E. Lutsky, I.V. Mursenkova, and I.A. Znamenskaya

Experimental Investigations on a Free-Flying Supersonic Projectile Model Submitted to an Electric Discharge Generating Plasma .................................................. 807
P. Gnemmi and C. Rey

Wave Profile and Current Limits for Lightning Return Stroke ................................................................. 813
M. Hemmati, W.C. Childs, R.S. Horn, and H.S. Shojaei

Part XIII Re-entry to Earth Atmosphere

In Situ Ablation Measurement for an Ablative Heat Shield Using an Embedded Sensor ................................. 821
T. Sakai, H. Nakazawa, Y. Dantsuka, K. Kitagawa, K. Hirai, and Y. Ishida

Preliminary Experimental Investigation of Air Radiation in Superorbital Expanding Flow ....................... 827
H. Wei, R.G. Morgan, U.A. Sheikh, P.A. Jacobs, R.J. Gollan, and T.J. McIntyre

Comparison of Chemical Reaction Models with Various Experimental Reentry Capsules Using DSMC ..................... 833
Tapan K. Mankodi, Upendra V. Bhandarkar, and Bhalchandra P. Puranik

Experimental and Numerical Assessment of Aerothermal Environments About Jupiter Trojan Sample Return Capsule ............ 839
K. Fujita, H. Takayanagi, S. Matsuyama, S. Nishimura,
K. Yamada, and T. Abe
# Contents

## Part XIV  Shock Waves in Rarefied Gases

Numerical Study of High-Energy Collisions Inside the Shock Wave in a Gas Mixture ........................................... 847  
F. Tcheremissine, O. Dodulad, and Yu. Kloss

A Numerical Investigation of Shock Propagation and Attenuation in a Three-Dimensional Micro-duct ................................. 853  
A. Deshpande and Bhalchandra P. Puranik

Experimental Study on the Interaction of Under-expanded Jets in Rarefied Flow Regimes ........................................ 859  
A. Vinod Yeldho Baby and B. Rajesh G.

Structure and Expansion of a Plume Emitted During Laser Ablation of Multicomponent Materials ................................. 869  
A.M. Słowicka, Z.A. Walenta, J. Hoffman, J. Chrzanowska, and T. Mościcki

Impact of the Interplanetary Magnetic Field to Impingement of a Solar Wind Rotational Discontinuity on the Earth’s Bow Shock ............................................. 875  
E.A. Pushkar

## Part XV  Shock Waves in Solids

Investigation on Shock Wave-Assisted Deformation of Nano Nickel ................................................................. 885  
Anuj Bisht, G. Jagadeesh, and Satyam Suwas

On the Shock-Induced Structures in Copper .................................................. 891  
Yu. Meshcheryakov, N.I. Zhigacheva, A. Divakov, G.V. Konovalov, and B. Barakhtin

Layered Pre-fragmentation Warhead Reveals Strong Shock Wave Effect .......................................................... 897  
Eitan Hirsch, Roman Shapiro, and Amos Raz

Structural Transformation in Two-Component Medium ........................................... 899  
D.A. Indeitsev, D.Yu. Skubov, and D.S. Vavilov

Application of Mathematical Programming for Analysis of Experimental Data Obtained at the Hopkinson’s Stand .......... 903  
Andrei Kuchmin and Andrei Abramyan

Criticality of Damage-Failure Transition in Quasi-Brittle Materials Under Dynamic and Shock Wave Loading .............................. 907  
O. Naimark

Shock Wave Response of Iron-Based Metallic Glass Matrix Composites .............................. 913  
Gauri R. Khanolkar, James P. Kelly, Olivia A. Graeve, Andrea M. Hodge, and Veronica Eliasson

Detonation Shock Waves in Various Media ............................................. 917  
Alex Zlatkis, Itzhak David, Maxim Teitel, and Evgeny Gofman

Detonation Velocity Dependence on Front Curvature for Overdriven Detonation in Solid Explosives ........................... 923  
Y. Partom
I.F. Barna and R. Kersner

Compression, Rarefaction, and Failure Waves in Silicate Glasses .......................... 933
G.I. Kanel, A.S. Savinykh, and S.V. Razorenov

A Study of Mass Loss at Hypervelocity Impacts of Projectiles with Single- and Multilayer Targets ......................................................... 939
A.D. Devir, A.B. Lessin, and A. Vaynshtein

The Head-On Collision of Normal Shock Waves with a Concrete Supported Plate ................................................................. 945
Gedalya Mazor, Dmitry Nemirovsky, and Uri Tzadka

Mechanisms of Stress Relaxation and Failure in Metals Under Shock Compression ................................................................. 949
Yu. Bayandin, O. Naimark, and N. Saveleva

Part XVI  Shock Waves in Liquids

Propagation of Pressure Waves in Compression System Prototype for Magnetized Target Fusion Reactor in General Fusion Inc. ........................................................................ 955
V. Suponitsky, D. Plant, E.J. Avital, and A. Munjiza

Intense Shock Wave Through Water and Impulse Transmission in Submerged Structure ................................................................. 961
Nilanjan Mitra

The Motion of a 2 mm Tantalum Block Induced by Underwater Explosion ................................................................. 965

On the Refraction of Shock Wave by a Cylindrical Water Droplet ................................................................. 971
S. Sembian, M. Liverts, N. Tillmark, and N. Apazidis

Fluid Rheology Effect on Wave Attenuation in an Elastic Pipe ................................................................. 977
S. Levitsky and R. Bergman

A Summary of the Experiments of Shock/Bubble Interactions Performed in IFS Since 1980 ................................................................. 983
K. Takayama

Analysis of Bubble Dynamics Created by Ballistic Impacts in Liquid-Filled Tanks ................................................................. 987
Thomas Fourest, Jean-Marc Laurens, Eric Deletombe, Jacques Dupas, and Michel Arrigoni

Air–Water Interface Jetting Induced by Explosion Load ................................................................. 991
Guifu Zhang, Yujian Zhu, and Jiming Yang

Part XVII  Shock Waves in Dense Gases

Shock Wave Attenuation in Milli- or Microtubes for Laminar and Turbulent Flow Regime ................................................................. 999
David E. Zeitoun

Comparison of BKW and JWL Equations of State for Explosion Simulations ................................................................. 1003
S. Amar, E. Kochavi, Y. Lefler, S. Vaintraub, and D. Sidilkover
Similarity Parameters for Shock Waves in Dense Fluids
Z.A. Walenta and A.M. Słowicka

Part XVIII  Shock Wave Focusing

Experimental Investigation of Shock Wave Amplification Using Multiple Munitions
Veronica Eliasson and J. Gross

Shock Focusing Effect for The Interaction of Blunt Bodies with Gas Bubbles in a Supersonic Flow
P. Georgievskiy, V. Levin, and O. Sutyrin

A Parameter Study of Shock Focusing Phenomenon for Shock-Elliptic Bubble Interaction
P. Georgievskiy, V. Levin, and O. Sutyrin

Coalescence and Interaction of Blast Waves Using Multiple Munitions
Shi Qiu and Veronica Eliasson

Temperature Measurements at the Focus of a Converging Spherical Shock Wave
M. Liverts, N. Tillmark, and N. Apazidis

Preliminary Design and Optimization of 2D Supersonic Intake Using OpenFOAM
D. Mukundhan and Rakesh Kumar

A New Method of Convergent Contour Design for Planar Shock Wave Enhancement in a Shock Tube
Dongwen Zhan, Yujian Zhu, and Jiming Yang

Investigations of Shock Wave Reflection and Focusing in Different Triangle Wedges
C. Zheng, Z. Chen, and X. Sun

Part XIX  Richtmyer–Meshkov Instability

Numerical Simulations of the Turbulent Richtmyer-Meshkov Instability in a Spherically Convergent Geometry
I. Boureima and P. Ramaprabhu

Richtmyer-Meshkov Instability in a Cylindrical Geometry Using a Conventional Shock Tube
Laurent Biamino, Georges Jourdan, Christian Mariani, Lazhar Houas, Marc Vandenboomgaerde, and Denis Souffland

A Semi-annular Cylindrically Converging Shock Tube for Richtmyer-Meshkov Instability Studies
Juchun Ding, Ting Si, Minghu Wang, and Xisheng Luo

Experimental Study on the Interaction of Cylindrical Converging Shock Waves with Sinusoidal Light-Heavy Interface
Fu Zhang, Zhigang Zhai, Ting Si, and Xisheng Luo

Effects of Density Distribution on Reshocked Gas Cylinder
Xiansheng Wang, Xisheng Luo, and Dangguo Yang
A Numerical Investigation of Shockwave-Cylindrical Gas Inhomogeneity Interaction for Convergent and Divergent Geometries ................................................................. 1097
M.P. Ray, Bhalchandra P. Puranik, and Upendra V. Bhandarkar

On the Richtmyer-Meshkov Instability of a Three-Dimensional Single-Mode Interface: Effect of Initial Interfacial Principal Curvatures ......................................................... 1103
B. Guan and Xisheng Luo

Numerical investigation of 3D effects on a 2D dominated flow .................. 1109
Daniel Reese and Chris Weber

Mach Number Influence on Ignition and Mixing Processes in a Reacting Shock–Bubble Interaction .......................................................... 1115
Felix Diegelmann, Volker Tritschler, and Stefan Hickel

Richtmyer-Meshkov Instability Shock Tube Experiments with Mixing Measurements .............................................................. 1121
V. Krivets, K. Ferguson, and J. Jacobs

Experimental Investigations of Three-Dimensional Shock-Vortex Loop Interaction: Shock Reflection and Diffraction Phenomena ............. 1127
T. Ukai, H. Zare-Behtash, K. Kontis, and S. Obayashi

Part XX Shock Boundary Layer Interaction

Shock Wave Boundary Layer Interaction Control by Rod Vortex Generators .......................................................... 1135
R. Szwaba and P. Doerffer

Consistency of Double Wedge Shock–Boundary Layer Interaction Between Numerical Simulation and Experiment .............................................. 1141
Xiaofeng Shi, Yujian Zhu, and Jiming Yang

Analysis of Upstream Conditions Effect on Shock Wave–Boundary Layer Interaction at Moderate Mach Number ................ 1147
Pavel Polivanov, Andrey Sidorenko, and Anatoly Maslov

Experimental Investigation of Shock-Bubble Properties at the Liquid–Air Phase Boundary ............................................................ 1153
W. Garen, B. Meyerer, Y. Kai, W. Neu, S. Koch, and U. Teubner

Numerical Study of a Transonic Wingtip Flow ....................................... 1159
James R. Grisham, Frank K. Lu, and Brian H. Dennis

Control of Unsteadiness in Shock Wave–Boundary Layer Interaction by Repetitive Laser Energy Deposition ........................................ 1165
T. Shoda, T. Tamba, S. Pham, A. Iwakawa, and A. Sasoh

Aeroheating Test of Double Cone Configurations in Shock Tunnel ........ 1171
Jiasui Zhou, Tao Jiang, Xiaowei Ma, Rongzong Kong, Kouli Zhang, and Runyu Tian

Induction Time Measurements in Shock Tube of Different Roughness .... 1177
O. Penyazkov and A. Skilandz
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control of Boundary Layer Separation in Supersonic Flow</td>
<td>1183</td>
</tr>
<tr>
<td>Using Injection Through Microramps</td>
<td></td>
</tr>
<tr>
<td>S. Vaisakh and T.M. Muruganandam</td>
<td></td>
</tr>
<tr>
<td>Shock-Induced Large Separation Bubbles Near the Leading Edge of a Flat Plate at Hypersonic Mach Numbers</td>
<td>1189</td>
</tr>
<tr>
<td>Srinath Lakshman, R. Sriram, and G. Jagadeesh</td>
<td></td>
</tr>
<tr>
<td>Flow Separation Control Over a Ramp with Nanosecond-Pulsed Plasma Actuators</td>
<td>1195</td>
</tr>
<tr>
<td>Y.D. Cui, Z.J. Zhao, J. Li, J.G. Zheng, and B.C. Khoo</td>
<td></td>
</tr>
<tr>
<td>Generation and Propagation of Shock Waves in Submillimeter Capillaries</td>
<td>1201</td>
</tr>
<tr>
<td>Y. Kai, W. Garen, and U. Teubner</td>
<td></td>
</tr>
<tr>
<td>Influence of Boundary Layer Bleed Slot Width onto Static and Total Pressure Recovery of a Shock Train</td>
<td>1205</td>
</tr>
<tr>
<td>A. Weiss and H. Olivier</td>
<td></td>
</tr>
<tr>
<td>Expansion Wave/Boundary Layer Interaction</td>
<td>1211</td>
</tr>
<tr>
<td>J. Thomas, B.W. Skews, and R.T. Paton</td>
<td></td>
</tr>
<tr>
<td>Shock Tunnel Studies of the Unsteady Hypersonic Flowfield Around Spiked Bodies</td>
<td>1217</td>
</tr>
<tr>
<td>G. Balakalyani, R. Sriram, and G. Jagadeesh</td>
<td></td>
</tr>
<tr>
<td>Plasma Control of Transonic Shock Wave/Boundary Layer Interaction</td>
<td>1223</td>
</tr>
<tr>
<td>Andrey Sidorenko, Alexey Budovskii, Pavel Polivanov, and Anatoly Maslov</td>
<td></td>
</tr>
<tr>
<td>Investigations on Unsteadiness and Instability of Shock/Boundary Layer Interactions of the Ramp Flow by DNS</td>
<td>1225</td>
</tr>
<tr>
<td>Dong Sun, Qin Li, and Hanxin Zhang</td>
<td></td>
</tr>
<tr>
<td>Design and Execution of a Hypersonic Boundary-Layer Trip Transition Experiment on Blunt Cone Flare Models with Distributed Roughness</td>
<td>1231</td>
</tr>
<tr>
<td>S. Seror, L. Kosarev, and Oren Sadot</td>
<td></td>
</tr>
<tr>
<td>Part XXI Multiphase Flow</td>
<td></td>
</tr>
<tr>
<td>Water Nucleation Measurements in a Pulse-Expansion Wave Tube</td>
<td>1239</td>
</tr>
<tr>
<td>M.A.L.J. Fransen, J. Hrubý, D.M.J. Smeulders, and M.E.H. van Dongen</td>
<td></td>
</tr>
<tr>
<td>Modified Ghost Fluid Method for the Fluid Elastic-Perfectly Plastic Solid Interaction</td>
<td>1245</td>
</tr>
<tr>
<td>S. Gao and T.G. Liu</td>
<td></td>
</tr>
<tr>
<td>Evolution of a Cloud of Cavitation Bubbles in a Disturbed Compressible Liquid: A Numerical Study</td>
<td>1251</td>
</tr>
<tr>
<td>N. Petrov and A. Schmidt</td>
<td></td>
</tr>
<tr>
<td>Towards Particle Image Velocimetry Measurements During Shock–Particle Curtain Interactions</td>
<td>1257</td>
</tr>
<tr>
<td>Justin L. Wagner, Steven J. Beresh, E. DeMauro, Brian O.M. Pruett, and P. Farias</td>
<td></td>
</tr>
<tr>
<td>Flow Separation in Rocket Nozzles Under High Altitude Condition</td>
<td>1263</td>
</tr>
<tr>
<td>R. Stark and C. Génin</td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>On the Early-Stage Deformation of Liquid Drop in Shock-Induced Flow</td>
<td>1269</td>
</tr>
<tr>
<td>Xiangyu Yi, Yujian Zhu, and Jiming Yang</td>
<td></td>
</tr>
<tr>
<td>Numerical Investigation of Shock-Induced Bubble Collapse in Water</td>
<td>1275</td>
</tr>
<tr>
<td>N. Apazidis</td>
<td></td>
</tr>
<tr>
<td>Suction Force Induced by the Collapse of a Near-Wall Bubble</td>
<td>1281</td>
</tr>
<tr>
<td>M. Sun</td>
<td></td>
</tr>
<tr>
<td>Toward the Prediction of Far-Field Pressure Induced</td>
<td>1287</td>
</tr>
<tr>
<td>by the Atmospheric Entry of a Small Meteorite</td>
<td></td>
</tr>
<tr>
<td>Ryo Maruyama and M. Sun</td>
<td></td>
</tr>
<tr>
<td>Pressure Field Produced by the Rapid Vaporization of a CO₂ Liquid</td>
<td>1293</td>
</tr>
<tr>
<td>Column</td>
<td></td>
</tr>
<tr>
<td>G. Ciccarelli, J. Melguizo-Gavilanes, and J.E. Shepherd</td>
<td></td>
</tr>
<tr>
<td>Penetration of Cryogenic Nitrogen Jets into a Liquid:</td>
<td>1299</td>
</tr>
<tr>
<td>“Phase Explosion” and Formation of Bubble Clusters</td>
<td></td>
</tr>
<tr>
<td>V. Kedrinskiy, V. Kuzavov, and G. Lazareva</td>
<td></td>
</tr>
<tr>
<td>Part XXII Blast Waves</td>
<td></td>
</tr>
<tr>
<td>Shock Wave Energy: Explosions in Air, Ground, and Water</td>
<td>1307</td>
</tr>
<tr>
<td>Lippe D. Sadwin, Michael M. Swisdak, Y. Gitterman, and Oren Lotan</td>
<td></td>
</tr>
<tr>
<td>The Energy Distribution of Explosions</td>
<td>1313</td>
</tr>
<tr>
<td>Hai Kedar, Lippe D. Sadwin, and David Ornai</td>
<td></td>
</tr>
<tr>
<td>Blast Wave Observations for Large-Scale Underwater Explosions</td>
<td>1315</td>
</tr>
<tr>
<td>in the Dead Sea</td>
<td></td>
</tr>
<tr>
<td>Y. Gitterman and Lippe D. Sadwin</td>
<td></td>
</tr>
<tr>
<td>Blast Waves Caused by Internal Explosion in Ammunition</td>
<td>1321</td>
</tr>
<tr>
<td>and Explosive Facility: Vulnerability and Protection Alternatives</td>
<td></td>
</tr>
<tr>
<td>David Ornai, Igal M. Shohet, Arie Boimel, Erez Gal, Robert Levy,</td>
<td></td>
</tr>
<tr>
<td>Sima M. El Kabetz, Liav Yaloz, and Eyal Mendel</td>
<td></td>
</tr>
<tr>
<td>Exploration of Methods in the Exploding Wire Technique</td>
<td>1327</td>
</tr>
<tr>
<td>for Simulating Large Blasts</td>
<td></td>
</tr>
<tr>
<td>E. Nof, O. Ram, E. Kochavi, Gabi Ben-Dor, and Oren Sadot</td>
<td></td>
</tr>
<tr>
<td>Development of a Vertical Shock Tube Facility for Blast Testing</td>
<td>1333</td>
</tr>
<tr>
<td>Applications</td>
<td></td>
</tr>
<tr>
<td>I. Obed Samuelraj and G. Jagadeeesh</td>
<td></td>
</tr>
<tr>
<td>Effects of Negative Overpressure Phase of a Laser Breakdown-Induced</td>
<td>1339</td>
</tr>
<tr>
<td>Blast Wave on Impulse Characteristics</td>
<td></td>
</tr>
<tr>
<td>The Influence of Soil Characteristics on the Blast Intensity</td>
<td>1345</td>
</tr>
<tr>
<td>of Buried Explosive Charges</td>
<td></td>
</tr>
<tr>
<td>Oded Drori, Zvi Assaf, Eylam Ran, Guy Golan, and Itzhak Kuchuk Katalan</td>
<td></td>
</tr>
<tr>
<td>Partitioning of a Scaled Shallow-Buried Near-Field Blast Load</td>
<td>1351</td>
</tr>
<tr>
<td>J.D. Reinecke, F.J. Beetge, I. Horsfall, and M. Miaymbo</td>
<td></td>
</tr>
<tr>
<td>Prevention of Blast Waves Focusing in Designing and Testing of Blast-</td>
<td>1357</td>
</tr>
<tr>
<td>Resistant Constructions</td>
<td></td>
</tr>
<tr>
<td>M.V. Silnikov, M.V. Chernyshov, N.A. Danilov, V.Ya. Dmitriev,</td>
<td></td>
</tr>
<tr>
<td>A.S. Pankov, V.N. Shishkin, and A.I. Spivak</td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Analysis and Testing of Combined Blast Inhibitors</td>
<td>1361</td>
</tr>
<tr>
<td>M.V. Silnikov, M.V. Chernyshov, N.A. Danilov, I.A. Melnikov, A.I. Mikhaylin, A.S. Pankov, V.N. Shishkin, and N.N. Vasilyev</td>
<td></td>
</tr>
<tr>
<td>Reconstruction of Recoilless Weapon Blast Environments</td>
<td>1367</td>
</tr>
<tr>
<td>Using High-Fidelity Simulations</td>
<td></td>
</tr>
<tr>
<td>Suthee Wiri, Thomas Wofford, Troy Dent, and Charles Needham</td>
<td></td>
</tr>
<tr>
<td>Development of a Risk-Informed Decision Support Model</td>
<td>1373</td>
</tr>
<tr>
<td>for Protecting an Urban Medical Center from a Nuclear Explosion</td>
<td></td>
</tr>
<tr>
<td>Benny Brosh, David Ormai, Igal M. Shohet, and Gabi Ben-Dor</td>
<td></td>
</tr>
<tr>
<td>Part XXIII Facilities</td>
<td></td>
</tr>
<tr>
<td>Behavior of the Shock Wave Propagating</td>
<td></td>
</tr>
<tr>
<td>in the Small-Diameter Tubes</td>
<td>1381</td>
</tr>
<tr>
<td>S. Udagawa, W. Garen, T. Inage, M. Ota, and K. Maeno</td>
<td></td>
</tr>
<tr>
<td>Hypersonic Research in the High-Enthalpy Shock Tunnel Göttingen</td>
<td>1385</td>
</tr>
<tr>
<td>K. Hannemann</td>
<td></td>
</tr>
<tr>
<td>Simulating Gas Giant Entry with Increased Helium</td>
<td>1391</td>
</tr>
<tr>
<td>Diluent in an Expansion Tube</td>
<td></td>
</tr>
<tr>
<td>C.M. James, D.E. Gildfind, R.G. Morgan, S.W. Lewis, and T.M. McIntyre</td>
<td></td>
</tr>
<tr>
<td>A New Sliding Joint to Accommodate Recoil of a Free-Piston Driven Expansion Tube</td>
<td>1397</td>
</tr>
<tr>
<td>D.E. Gildfind and R.G. Morgan</td>
<td></td>
</tr>
<tr>
<td>A Comparative Study of Shockwave Propagation in Different Diameter Miniature Shock Tubes</td>
<td>1401</td>
</tr>
<tr>
<td>S. Janardhanraj and G. Jagadeesh</td>
<td></td>
</tr>
<tr>
<td>Indraft Supersonic Wind Tunnel for Shock Train Investigations</td>
<td>1407</td>
</tr>
<tr>
<td>F. Gnani, H. Zare-Behtash, and K. Kontis</td>
<td></td>
</tr>
<tr>
<td>Experiments Using Reddy Tube-Driven Tabletop Hypersonic Shock Tunnel</td>
<td>1413</td>
</tr>
<tr>
<td>K.P.J. Reddy, N. Sharath, Ramesh Babu, and Chintoo S. Kumar</td>
<td></td>
</tr>
<tr>
<td>Rapid Assessment on Flow Parameter Matching Scheme</td>
<td>1419</td>
</tr>
<tr>
<td>in Aerodynamic Testing in a Combustion Wind Tunnel</td>
<td></td>
</tr>
<tr>
<td>Kunwei Liu, Yujian Zhu, Jiming Yang, and Yingchuan Wu</td>
<td></td>
</tr>
<tr>
<td>The T4 Stalker Tube</td>
<td>1425</td>
</tr>
<tr>
<td>David J. Mee, R.G. Morgan, Allan Paull, P.A. Jacobs, and Michael K. Smart</td>
<td></td>
</tr>
<tr>
<td>Stalker Tube Activities in India</td>
<td>1431</td>
</tr>
<tr>
<td>K.P.J. Reddy</td>
<td></td>
</tr>
<tr>
<td>Part XXIV Flow Visualization</td>
<td></td>
</tr>
<tr>
<td>Tomographic Visualization of the Hypersonic Flow Field over a Waverider</td>
<td>1437</td>
</tr>
<tr>
<td>K. Nagashetty, Biswajit Medhi, R. Sriram, G. Jagadeesh, and K.P.J. Reddy</td>
<td></td>
</tr>
<tr>
<td>Effect of Primary Flow Mach Number on the Non-mixed Length in a Two-Dimensional Supersonic Ejector</td>
<td>1441</td>
</tr>
</tbody>
</table>
Contents

Pulse-Burst PIV in a High-Speed Wind Tunnel .................................................. 1447
Steven J. Beresh, Justin L. Wagner, John F. Henfling, Russell W. Spillers,
and Brian O.M. Pruett

A Novel Pressure-Sensitive Luminescent Coating for Microscale
Flow Visualization ..................................................................................... 1451
Y. Sakamura, S. Kawabata, Y. Arai, and K. Nagano

Handheld Wavefront Measuring Camera for Quantitative
Flow Visualization ................................................................................... 1455

Flow Visualization of the Exhaust Jet from a Pulse Detonation
Engine by Mie Scattering ................................................................. 1461
F.K. Lu, D.D. Joshi, J.T. Peace, R.T. Bello, and J.D. Carter

Design of a Focusing Schlieren Setup for Use in a Supersonic
Combustion Chamber ........................................................................... 1467
Manuel N. Bühler, Felix J. Förster, Nils C. Dröské, Jens von Wolfersdorf,
and Bernhard Weigand

Improved Flow Visualization for Fast Recovery of Flow Gradients
in Shadow-Casting Technique ............................................................. 1473
Biswajit Medhi, Abhishek Khatta, G.M. Hegde, K.P.J. Reddy,
D. Roy, and R.M. Vasu

Quantitative Flow Visualization by Wavefront Reconstruction:
A Focal Stack Approach ........................................................................ 1477
Biswajit Medhi, Vikas M. Shelar, G.M. Hegde, K.P.J. Reddy,
D. Roy, and R.M. Vasu

Shock Induced Flow Through a Pipegap .............................................. 1481
S. Kapfudzaruwa, B.W. Skews, and R.T. Paton

Part XXV Numerical Methods

New Methods for Resolution Improvement in Simulations
on Subtle Structures Generated by Shock Waves ............................... 1489
Qin Li, Pengxin Liu, and Hanxin Zhang

H. Shen and C.Y. Wen

Development of an Unsteady Shock-Fitting Technique
for Unstructured Grids ........................................................................ 1501
Aldo Bonfiglioli, Renato Paciorri, Lorenzo Campoli, Valentina De Amicis,
and Marcello Onofri

On the Propagation of Curved Shockwaves Using Geometric
Shock Dynamics ....................................................................................... 1505
Bright B. Ndebele, B.W. Skews, and R.T. Paton

Part XXVI Commercial Lecture

Engineering Tools for the Analysis of Penetration and Fragmentation ........ 1513
T. Hartmann, E. Rottenkolber, and Arie Boimel

Author Index ................................................................................................. 1519

Subject Index ............................................................................................... 1525
Contributors

T. Abe  Japan Aerospace Exploration Agency, Chofu, Tokyo, Japan
Andrei Abramyan  Laboratory of Hydroelasticity, Institute of Problems in Mechanical Engineering (IPME RAS), Saint Petersburg, Russia
Budovskii Alexey  Flow Control Lab, Institute of Theoretical and Applied Mechanics (ITAM SB RAS), Novosibirsk, Russia
S. Amar  Soreq NRC, Yavne, Israel
Valentina De Amicis  Università degli Studi di Roma “La Sapienza”, Rome, Italy
K.K.N. Anbuselvan  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India
N. Apazidis  Department of Mechanics, KTH-Royal Institute of Technology, Stockholm, Sweden
Y. Arai  Toyama Prefectural University, Toyama, Japan
Michel Arrigoni  LBMS, ENSTA Bretagne, Brest, France
Zvi Assaf  Plasan Ltd., M.P. Merom Hagalil, Israel
E. J. Avital  School of Engineering and Materials Science, Queen Mary University of London, London, UK
Ramesh Babu  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India
A. Vinod Yeldho Baby  Department of Aerospace Engineering, Indian Institute of Technology Madras, Chennai, India
Department of Mechanical Engineering, Mar Athanasius College of Engineering, Kerala, India
G. Balakalyani  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India
B. Barakhtin  Central Institute of Constructional Materials “Prometei”, Saint-Petersburg, Russia
I.F. Barna  Wigner Research Centre of the Hungarian Academy of Sciences, Budapest, Hungary
Yu Bayandin  Institute of Continuous Media Mechanics, UB RAS, Perm, Russia
F.J. Beetge  Armaments Corporation of South Africa Limited (Armscor), Pretoria, South Africa
Contributors

Pat Belancourt  Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA

R.T. Bello  Aerodynamics Research Center, Mechanical and Aerospace Engineering Department, University of Texas at Arlington, Arlington, TX, USA

Gabi Ben-Dor  Department of Mechanical Engineering, Ben-Gurion University of the Negev, Beer-Sheva, Israel

Steven J. Beresh  Sandia National Laboratories, Albuquerque, NM, USA

R. Bergman  Shamoon College of Engineering, Beer Sheva, Israel

Upendra V. Bhandarkar  Department of Mechanical Engineering, Indian Institute of Technology Bombay, Mumbai, India

Laurent Biamino  CNRS, IUSTI UMR 7343, Aix-Marseille University, Marseille, France

Anuj Bisht  Centre for Nanoscience and Engineering, Indian Institute of Science Bangalore, Bangalore, India

Arie Boimel  Boimel Consulting, Petah-Tiqwa, Israel

Structural Engineering, Beersheba, Israel

Aldo Bonfiglioli  Università degli Studi della Basilicata, Potenza, Italy

I. Boureima  University of North Carolina at Charlotte, Charlotte, NC, USA

B. Ndebele Bright  Flow Research Unit, School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa

Benny Brosh  Department of Structural Engineering, Ben-Gurion University of the Negev, Beersheba, Israel

Manuel N. Bühler  Institute of Aerospace Thermodynamics, University of Stuttgart, Stuttgart, Germany

Lorenzo Campoli  Università degli Studi di Roma “La Sapienza”, Rome, Italy

J.D. Carter  Aerodynamics Research Center, Mechanical and Aerospace Engineering Department, University of Texas at Arlington, Arlington, TX, USA

Hui Chen  Physics, Lawrence Livermore National Laboratory, Livermore, CA, USA

Z. Chen  Key Laboratory of Transient Physics, Nanjing University of Science and Technology, Nanjing, China

M.V. Chernyshov  Special Materials Corp., St. Petersburg, Russia

Peter the Great Saint Petersburg Polytechnic University, St. Petersburg, Russia

W.C. Childs  Department of Physical Science, Arkansas Tech University, Russellville, AR, USA

J. Chrzanowska  Department of Strength Materials, Institute of Fundamental Technological Research, Polish Academy of Sciences, Warszawa, Poland

G. Ciccarelli  Queen’s University, Kingston, ON, Canada

Y.D. Cui  Temasek Laboratories, National University of Singapore, Singapore, Singapore

N.A. Danilov  Special Materials Corp., St. Petersburg, Russia

Peter the Great Saint Petersburg Polytechnic University, St. Petersburg, Russia

Y. Dantsuka  Nagoya University, Furocho, Chikusa-ku, Nagoya, Japan
Contributors

Itzhak David  IDF—Israel Defense Force, Jerusalem, Israel
Eric Deletombe  DADS, ONERA—The French Aerospace Lab, Palaiseau, France
E. DeMauro  Sandia National Laboratory, Albuquerque, NM, USA
Brian H. Dennis  Director of the Computational Fluid Dynamics Lab and Professor
Troy Dent  Southwest Division, Albuquerque, NM, USA
A. Deshpande  Department of Mechanical Engineering, Indian Institute of Technology Bombay, Mumbai, India
A.D. Devir  IARD Sensing Solutions LTD, Kibbutz Yagur, Israel
Felix Diegelmann  Institute for Aerodynamics and Fluid Mechanics, Technische Universität München, Garching bei München, Germany
Juchun Ding  Advanced Propulsion Laboratory, University of Science and Technology of China, Hefei, China
A. Divakov  Institute of Problems of Mechanical Engineering RAS, Saint-Petersburg, Russia
V. Ya. Dmitriev  Special Materials Corp., St. Petersburg, Russia
O. Dodulad  National Research Centre “Kurchatov Institute”, Moscow, Russia
Moscow Institute of Physics and Technology, Dolgoprudny, Russia
P. Doerffer  Institute of Fluid-Flow Machinery, Polish Academy of Sciences, Gdansk, Poland
M.E.H. van Dongen  Eindhoven University of Technology, MB Eindhoven, The Netherlands
R.P. Drake  Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA
Oded Drori  Plasan Ltd., M.P. Merom Hagalil, Israel
Nils C. Dröske  Institute of Aerospace Thermodynamics, University of Stuttgart, Stuttgart, Germany
Jacques Dupas  DADS, ONERA—The French Aerospace Lab, Palaiseau, France
Veronica Eliasson  Department of Aerospace and Mechanical Engineering, University of Southern California, Los Angeles, CA, USA
Department of Structural Engineering, University of California, San Diego, La Jolla, CA, USA
P. Farias  Sandia National Laboratory, Albuquerque, NM, USA
Jeff Fein  Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA
K. Ferguson  Department of Aerospace and Mechanical Engineering, University of Arizona, Tucson, AZ, USA
Felix J. Förster  Institute of Aerospace Thermodynamics, University of Stuttgart, Stuttgart, Germany
Thomas Fourest  DADS, ONERA—The French Aerospace Lab, Palaiseau, France
LBMS, ENSTA Bretagne, Brest, France
M.A.L.J. Fransen  Eindhoven University of Technology, MB Eindhoven, The Netherlands
K. Fujita  Japan Aerospace Exploration Agency, Chofu, Tokyo, Japan
Contributors

E. Gal Department of Structural Engineering, Ben-Gurion University of the Negev, Beersheba, Israel

S. Gao LMIB and School of Mathematics and Systems Science, Beihang University, Beijing, People’s Republic of China

W. Garen Hochschule Emden/Leer, Institute for Laser and Optics, University of Applied Sciences, Constantiaplatz 4, Emden, Germany

C. Génin German Aerospace Center (DLR), Langer Grund, Lampoldshausen, Germany

P. Georgievskiy Institute of Mechanics, Lomonosov Moscow State University, Moscow, Russia

D.E. Gildfind The School of Mechanical and Mining Engineering, The Centre for Hypersonics, The University of Queensland, Brisbane, QLD, Australia

Y. Gitterman Seismology Division, Geophysical Institute of Israel, Lod, Israel

F. Gnani School of Engineering, University of Glasgow, Glasgow, UK

P. Gnemmi French German Research Institute of Saint-Louis (ISL), Saint-Louis Cedex, France

Evgeny Gofman IDF—Israel Defense Force, Jerusalem, Israel

Guy Golan Plasan Ltd., M.P. Merom Hagalil, Israel

R.J. Gollan Centre for Hypersonics, School of Mechanical and Mining Engineering, The University of Queensland, St. Lucia, QLD, Australia

T. Gonai Department of Aerospace Engineering, Graduate School of Engineering, Tohoku University, Sendai, Japan

Olivia A. Graeve Department of Mechanical and Aerospace Engineering, University of California San Diego, La Jolla, CA, USA

James R. Grisham Graduate Student

J. Gross University of Southern California, Los Angeles, CA, USA

B. Guan Department of Modern Mechanics, University of Science and Technology of China, Hefei, People’s Republic of China

E. Gubanov Joint Institute for High Temperatures, Russian Academy of Sciences, Moscow, Russia

Guifu Zhang Department of Modern Mechanics, University of Science and Technology of China, Hefei, Anhui, China

K. Hannemann Institute of Aerodynamics and Flow Technology, Spacecraft Department, German Aerospace Center, DLR, Göttingen, Germany

T. Hartmann NUMERICS GmbH, Petershausen, Germany

Andrew Hazi Physics, Lawrence Livermore National Laboratory, Livermore, CA, USA

G.M. Hegde Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore, India

M. Hemmati Department of Physical Science, Arkansas Tech University, Russellville, AR, USA

John F. Henfling Sandia National Laboratories, Albuquerque, NM, USA

Stefan Hickel Faculty of Aerospace Engineering, TU Delft, HS Delft, The Netherlands
Contributors

K. Hirai  IHI Aerospace Co. LTD, Fujiki, Tomioka, Japan
Eitan Hirsch  Private Consultant, Netanya, Israel
Andrea M. Hodge  Department of Aerospace and Mechanical Engineering, University of Southern California, Los Angeles, CA, USA
Mork Family Department of Chemical Engineering and Materials Science, University of Southern California, Los Angeles, CA, USA
J. Hoffman  Department of Strength Materials, Institute of Fundamental Technological Research, Polish Academy of Sciences, Warszawa, Poland
R.S. Horn  Department of Physical Science, Arkansas Tech University, Russellville, AR, USA
I. Horsfall  Defence and Security, Cranfield University, Shrivenham, UK
Lazhar Houas  Aix-Marseille University, CNRS, IUSTI UMR 7343, Marseille, France
J. Hrubý  Institute of Thermomechanics, Academy of Sciences of the Czech Republic, Prague 8, Czech Republic
T. Inage  Salesian Polytechnic, Machida, Tokyo, Japan
D.A. Indeitsev  Institute for Problems in Mechanical Engineering, St. Petersburg, Russia
Y. Ishida  Japan Aerospace Exploration Agency, Jindaiji-Higashi-machi, Chofu, Japan
A. Iwakawa  Department of Aerospace Engineering, Nagoya University, Nagoya, Japan
P.A. Jacobs  Centre for Hypersonics, School of Mechanical and Mining Engineering, The University of Queensland, Brisbane, QLD, Australia
J. Jacobs  Department of Aerospace and Mechanical Engineering, University of Arizona, Tucson, AZ, USA
G. Jagadeesh  Department of Aerospace Engineering, Indian Institute of Science Bangalore, Bangalore, India
C.M. James  The School of Mechanical and Mining Engineering, The Centre for Hypersonics, The University of Queensland, Brisbane, QLD, Australia
S. Janardhanraaj  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India
Zhou Jiasui  China Aerodynamics Research and Development Center, Hypervelocity Aerodynamics Institute, Mianyang, China
D.D. Joshi  Aerodynamics Research Center, Mechanical and Aerospace Engineering Department, University of Texas at Arlington, Arlington, TX, USA
Georges Jourdan  Aix-Marseille University, CNRS, IUSTI UMR 7343, Marseille, France
S.M. El Kabetz  Department of Structural Engineering, Ben-Gurion University of the Negev, Beersheba, Israel
Y. Kai  Hochschule Emden/Leer, Institute for Laser and Optics, University of Applied Sciences, Emden, Germany
Institute of Physics, Carl von Ossietzky University of Oldenburg, Oldenburg, Germany
G.I. Kanel  Joint Institute for High Temperatures of Russian Academy of Sciences, Moscow, Russia
National Research Tomsk State University, Tomsk, Russia
S. Kapfudzaruwa  Flow Research Unit, University of the Witwatersrand, Johannesburg, Johannesburg, South Africa

S.K. Karthick  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India

Itzhak Kuchuk Katalan  Plasan Ltd., M.P. Merom Hagalil, Israel

S. Kawabata  Toyama Prefectural University, Toyama, Japan

Hai Kedar  Mechanical Engineering Department, Ben-Gurion University of the Negev, Beer Sheva, Israel

V. Kedrinskiy  Lavrentyev Institute of Hydrodynamics, SB RAS, Novosibirsk, Russia

Paul Keiter  Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA

James P. Kelly  Department of Mechanical and Aerospace Engineering, University of California San Diego, La Jolla, CA, USA

R. Kersner  Department of Mathematics, University of Pécs, Pécs, Hungary

Gauri R. Khanolkar  Department of Aerospace and Mechanical Engineering, University of Southern California, Los Angeles, CA, USA

Abhishek Khatta  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India

B.C. Khoo  Temasek Laboratories, National University of Singapore, Singapore, Singapore

K. Kitagawa  Aichi Institute of Technology, Yakusa-cho, Toyota, Japan

Sallee Klein  Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA

Yu. Kloss  National Research Centre “Kurchatov Institute”, Moscow, Russia

S. Koch  Hochschule Emden/Leer, Institute for Laser and Optics, University of Applied Sciences, Emden, Germany

E. Kochavi  Department of Mechanical Engineering, Ben-Gurion University of the Negev, Beer Sheva, Israel

T. Koita  Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Sendai, Japan

G.V. Konovalov  Institute of Problems of Mechanical Engineering RAS, Saint-Petersburg, Russia

K. Kontis  School of Engineering, University of Glasgow, Glasgow, Scotland, UK

Zhang Kouli  China Aerodynamics Research and Development Center, Hypervelocity Aerodynamics Institute, Mianyang, China

V. Krivets  Department of Aerospace and Mechanical Engineering, University of Arizona, Tucson, AZ, USA

Andrei Kuchmin  Laboratory of Mechanics of Controlled Systems, Institute of Problems in Mechanical Engineering (IPME RAS), Saint-Petersburg, Russia
R. Kumar  Indian Institute of Technology, Kanpur, UP, India
Chintoo S. Kumar  Srushti Education Systems, Bangalore, India
Carolyn Kuranz  Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA
V. Kuzavov  Lavrentyev Institute of Hydrodynamics, SB RAS, Novosibirsk, Russia
Srinath Lakshman  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, Karnataka, India
Jean-Marc Laurens  LBMS, ENSTA Bretagne, Brest, France
G. Lazareva  Lavrentyev Institute of Hydrodynamics, SB RAS, Novosibirsk, Russia
Institute of Computational Mathematics and Mathematical Geophysics, SB RAS, Novosibirsk, Russia
Y. Lefler  Soreq NRC, Yavne, Israel
A.B. Lessin  IARD Sensing Solutions LTD, Kibbutz Yagur, Israel
V. Levin  Institute of Mechanics, Lomonosov Moscow State University, Moscow, Russia
S. Levitsky  Shamoon College of Engineering, Beer Sheva, Israel
R. Levy  Department of Structural Engineering, Ben-Gurion University of the Negev, Beersheba, Israel
Protective Technologies Research and Development Center, Ben-Gurion University of the Negev, Beersheba, Israel
S.W. Lewis  The School of Mechanical and Mining Engineering, The Centre for Hypersonics, The University of Queensland, Brisbane, QLD, Australia
J. Li  Temasek Laboratories, National University of Singapore, Singapore, Singapore
Qin Li  State Key Laboratory of Aerodynamics, China Aerodynamics Research and Development Center, Mianyang, Sichuan, China
A. Likhachev  Joint Institute for High Temperatures, Russian Academy of Sciences, Moscow, Russia
Kunwei Liu  Department of Modern Mechanics, University of Science and Technology of China, Hefei, People’s Republic of China
Pengxin Liu  State Key Laboratory of Aerodynamics, China Aerodynamics Research and Development Center, Mianyang, Sichuan, China
T.G. Liu  LMIB and School of Mathematics and Systems Science, Beihang University, Beijing, People’s Republic of China
M. Liverts  Mechanics, KTH—Royal Institute of Technology, Stockholm, Sweden
Oren Lotan  Technical Branch, Israeli Navy, Tel Aviv, Israel
F.K. Lu  Director of Aerodynamics Research Center and Professor
Xisheng Luo  Advanced Propulsion Laboratory, Department of Modern Mechanics, University of Science and Technology of China, Hefei, China
A.E. Lutsky  Department of Physics, Moscow State University, Moscow, Russia
Xiaowei Ma  China Aerodynamics Research and Development Center, Hypervelocity Aerodynamics Institute, Mianyang, China
Michael MacDonald  Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA

K. Maeno  National Institute of Technology, Kisarazu College, Chiba, Japan

Tapan K. Mankodi  Department of Mechanical Engineering, Indian Institute of Technology Bombay, Mumbai, India

Mario Manuel  Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA

Christian Mariani  Aix-Marseille University, CNRS, IUSTI UMR 7343, Marseille, France

Ryo Maruyama  School of Engineering, Tohoku University, Sendai, Japan

Anatoly Maslov  Laboratory of Nonequilibrium Processes, Novosibirsk State University, Novosibirsk, Russia

S. Matsuyama  Japan Aerospace Exploration Agency, Chofu, Tokyo, Japan

Gedalya Mazor  Mechanical Engineering Department, Shamoon College of Engineering, Beer Sheva, Israel

T.M. McIntyre  The School of Mathematics and Physics, The University of Queensland, Brisbane, QLD, Australia

T. J. McIntyre  Centre for Hypersonics, School of Mathematics and Physics, The University of Queensland, St Lucia, QLD, Australia

Biswajit Medhi  Department of Instrumentation and Applied Physics, Indian Institute of Science, Bangalore, India

S. Medin  Joint Institute for High Temperatures, Russian Academy of Sciences, Moscow, Russia

David J. Mee  Centre for Hypersonics, School of Mechanical and Mining Engineering, The University of Queensland, Brisbane, QLD, Australia

J. Melguizo-Gavilanes  California Institute of Technology, Pasadena, CA, USA

I.A. Melnikov  Special Materials Corp., St. Petersburg, Russia

Peter the Great Saint Petersburg Polytechnic University, St. Petersburg, Russia

E. Mendel  Department of Mechanical Engineering, Ben-Gurion University of the Negev, Beersheba, Israel

Yu. Meshcheryakov  Institute of Problems of Mechanical Engineering RAS, Saint-Petersburg, Russia

B. Meyerer  Hochschule Emden/Leer, Institute for Laser and Optics, University of Applied Sciences, Emden, Germany

M. Miaymbo  Council for Scientific and Industrial Research (CSIR), Pretoria, South Africa

A.I. Mikhaylin  Special Materials Corp., St. Petersburg, Russia

Peter the Great Saint Petersburg Polytechnic University, St. Petersburg, Russia

Nilanjan Mitra  Indian Institute of Technology, Kharagpur, India

R.G. Morgan  The School of Mechanical and Mining Engineering, The Centre for Hypersonics, The University of Queensland, Brisbane, QLD, Australia

Centre for Hypersonics, School of Mechanical and Mining Engineering, The University of Queensland, Brisbane, QLD, Australia
T. Mościcki Department of Strength Materials, Institute of Fundamental Technological Research, Polish Academy of Sciences, Warszawa, Poland

D. Mukundhan Indian Institute of Technology, Kanpur, UP, India

A. Munjiza School of Engineering and Materials Science, Queen Mary University of London, London, UK

I.V. Mursenkova Department of Physics, Moscow State University, Moscow, Russia

T. M. Muruganandam Department of Aerospace Engineering, Indian Institute of Technology Madras, Chennai, India

K. Nagano Toyama Prefectural University, Toyama, Japan
Sato Tekko Co., Ltd., Toyama, Japan

K. Nagashetty Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India

O. Naimark Institute of Continuous Media Mechanics UB RAS, Perm, Russia

T. Nakamura Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Sendai, Japan

H. Nakazawa Nagoya University, Furocho, Chikusa-ku, Nagoya, Japan

Charles Needham Southwest Division, Albuquerque, NM, USA

Dmitry Nemirovsky Physics Department, Shamoon College of Engineering, Beer Sheva, Israel

W. Neu Hochschule Emden/Leer, Institute for Laser and Optics, University of Applied Sciences, Emden, Germany

S. Nishimura Shizuoka University, Shizuoka, Japan

E. Nof Department of Mechanical Engineering, Ben-Gurion University of the Negev, Beer Sheva, Israel

S. Obayashi Institute of Fluid Science, Tohoku University, Sendai, Japan

H. Olivier Shock Wave Laboratory, Aachen, Germany

Marcello Onofri Università degli Studi di Roma “La Sapienza”, Rome, Italy

David Ornai Department of Structural Engineering, Ben-Gurion University of the Negev, Beer-Sheva, Israel
Protective Technologies Research and Development Center, Ben-Gurion University of the Negev, Beer-Sheva, Israel

M. Ota Chiba University, Chiba, Japan

S. Owada Faculty of Science and Engineering, Waseda University, Tokyo, Japan

Renato Paciorri Università degli Studi di Roma “La Sapienza”, Rome, Italy

A. S. Pankov Special Materials Corp., St. Petersburg, Russia
Peter the Great Saint Petersburg Polytechnic University, St. Petersburg, Russia

Jaebum Park Physics, Lawrence Livermore National Laboratory, Livermore, CA, USA

Y. Partom Rafael, Haifa, Israel
R.T. Paton  Flow Research Unit, School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa

Allan Paull  Applied Hypersonics Branch, Defence Science and Technology Organisation, Brisbane, QLD, Australia

J.T. Peace  Aerodynamics Research Center, Mechanical and Aerospace Engineering Department, University of Texas at Arlington, Arlington, TX, USA

O. Penyazkov  A.V. Luikov Heat and Mass Transfer Institute, Minsk, Belarus

N. Petrov  Computational Physics Laboratory, Ioffe Institute, St. Petersburg, Russia

S. Pham  Department of Aerospace Engineering, Nagoya University, Nagoya, Japan

D. Plant  General Fusion Inc., Burnaby, BC, Canada

Pavel Polivanov  Laboratory of Nonequilibrium Processes, Novosibirsk State University, Novosibirsk, Russia

P.A. Polivanov  Khristianovich Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia

Brad Pollock  Physics, Lawrence Livermore National Laboratory, Livermore, CA, USA

Brian O. M. Pruett  Sandia National Laboratory, Albuquerque, NM, USA

Bhalchandra P. Puranik  Department of Mechanical Engineering, Indian Institute of Technology, Bombay, Mumbai, India

E.A. Pushkar  Moscow State University of Mechanical Engineering (MAMI), Moscow, Russia

Shi Qiu  Department of Aerospace and Mechanical Engineering, University of Southern California, Los Angeles, CA, USA

B. Rajesh G.  Department of Aerospace Engineering, Indian Institute of Technology Madras, Chennai, India

O. Ram  Department of Mechanical Engineering, Ben-Gurion University of the Negev, Beer Sheva, Israel

P. Ramaprabhu  University of North Carolina at Charlotte, Charlotte, NC, USA

Eylam Ran  Plasan Ltd., M.P. Merom Hagalil, Israel

Paton Randall  Flow Research Unit, School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa

M.V. Srisha Rao  Department of Mechanical, Aerospace and Materials Engineering, Muroran Institute of Technology, Muroran, Japan

Alex Rasmus  Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA

M.P. Ray  Department of Mechanical Engineering, Indian Institute of Technology Bombay, Mumbai, India

Amos Raz  Elbit Systems LTD, Haifa, Israel

S.V. Razorenov  National Research Tomsk State University, Tomsk, Russia

Institute of Problems of Chemical Physics of Russian Academy of Sciences, Chernogolovka, Russia
K.P.J. Reddy  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India

Daniel Reese  University of Wisconsin, Madison, WI, USA
Lawrence Livermore National Laboratory, Livermore, CA, USA

J.D. Reinecke  Council for Scientific and Industrial Research (CSIR), Pretoria, South Africa

C. Rey  French German Research Institute of Saint-Louis (ISL), Saint-Louis Cedex, France

Kong Rongzong  China Aerodynamics Research and Development Center, Hypervelocity Aerodynamics Institute, Mianyang, China

E. Rottenkolber  NUMERICS GmbH, Petershausen, Germany

D. Roy  Department of Civil Engineering, Indian Institute of Science, Bangalore, India

Tian Runyu  China Aerodynamics Research and Development Center, Hypervelocity Aerodynamics Institute, Mianyang, China

Oren Sadot  Department of Mechanical Engineering, Ben-Gurion University of the Negev, Beer Sheva, Israel

Lippe D. Sadwin  Sadwin Engineering Consultancy, Kefar Pines, Israel

T. Sakai  Nagoya University, Furocho, Chikusa-ku, Nagoya, Japan

Y. Sakamura  Toyama Prefectural University, Toyama, Japan

I. Obed Samuelraj  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India

A. Sasoh  Department of Aerospace Engineering, Nagoya University, Nagoya, Japan

N. Saveleva  Institute of Continuous Media Mechanics, Perm, Russia

A.S. Savinykh  National Research Tomsk State University, Tomsk, Russia
Institute of Problems of Chemical Physics of Russian Academy of Sciences, Chernogolovka, Russia

A. Schmidt  Computational Physics Laboratory, Ioffe Institute, St. Petersburg, Russia

S. Sembian  Mechanics, KTH—Royal Institute of Technology, Stockholm, Sweden

Roman Shapiro  Elbit Systems LTD, Haifa, Israel

N. Sharath  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India

U.A. Sheikh  Centre for Hypersonics, School of Mechanical and Mining Engineering, The University of Queensland, St. Lucia, QLD, Australia
Centre de Recherches en Physique des Plasmas, Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland

Vikas M. Sheler  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India

H. Shen  The Hong Kong Polytechnic University, Kowloon, Hong Kong

J.E. Shepherd  California Institute of Technology, Pasadena, CA, USA
Xiaofeng Shi  Department of Modern Mechanics, University of Science and Technology of China, Heifei, People’s Republic of China

V.N. Shishkin  Special Materials Corp., St. Petersburg, Russia
Peter the Great Saint Petersburg Polytechnic University, St. Petersburg, Russia

T. Shoda  Department of Aerospace Engineering, Nagoya University, Nagoya, Japan

I.M. Shohet  Department of Structural Engineering, Ben-Gurion University of the Negev, Beersheva, Israel
Protective Technologies Research and Development Center, Ben-Gurion University of the Negev, Beersheva, Israel

H.S. Shojaei  Department of Physical Science, Arkansas Tech University, Russellville, AR, USA

Ting Si  Advanced Propulsion Laboratory, Department of Modern Mechanics, University of Science and Technology of China, Hefei, China

D. Sidilkover  Soreq NRC, Yavne, Israel
Andrey Sidorenko  Laboratory of Nonequilibrium Processes, Novosibirsk State University, Novosibirsk, Russia

M.V. Silnikov  Special Materials Corp., St. Petersburg, Russia
Peter the Great Saint Petersburg Polytechnic University, St. Petersburg, Russia

B.W. Skews  Flow Research Unit, School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa

A. Skilandz  A.V. Luikov Heat and Mass Transfer Institute, Minsk, Belarus

D. Yu. Skubov  St. Petersburg Polytechnic University, St. Petersburg, Russia

A.M. Slowicka  Institute of Fundamental Technological Research, Polish Academy of Sciences, Warszawa, Poland

A.M. Slowicka  Department of Fluid Mechanics, Institute of Fundamental Technological Research, Polish Academy of Sciences, Warszawa, Poland

Michael K. Smart  Applied Hypersonics Branch, Defence Science and Technology Organisation, Brisbane, QLD, Australia

D.M. J. Smeulders  Eindhoven University of Technology, MB Eindhoven, The Netherlands

Denis Souffland  CEA-DAM, DIF, Arpajon, France

Russell W. Spillers  Sandia National Laboratories, Albuquerque, NM, USA

A.I. Spivak  Special Materials Corp., St. Petersburg, Russia

R. Sriram  Department of Aerospace Engineering, Indian Institute of Science, Bangalore, Karnataka, India

R. Stark  German Aerospace Center (DLR), Langer Grund, Lampoldshausen, Germany

M. Sun  Institute of Fluid Science, Tohoku University, Sendai, Japan

X. Sun  Aerospace System Engineering, Shanghai, China

Dong Sun  State Key Laboratory of Aerodynamics, Mianyang, Sichuan, China

V. Suponitsky  General Fusion Inc., Burnaby, BC, Canada
Contributors

O. Sutyrin  Institute of Mechanics, Lomonosov Moscow State University, Moscow, Russia

Satyam Suwas  Department of Materials Engineering, Indian Institute of Science Bangalore, Bangalore, India

Michael M. Swisdak  APT Research Inc., Huntsville, AL, USA

R. Szwaba  Institute of Fluid-Flow Machinery, Polish Academy of Sciences, Gdansk, Poland

K. Takayama  Emeritus Tohoku University, Sendai, Japan

H. Takayanagi  Japan Aerospace Exploration Agency, Chofu, Tokyo, Japan

T. Tamba  Department of Aerospace Engineering, Nagoya University, Nagoya, Japan

Jiang Tao  China Aerodynamics Research and Development Center, Hypervelocity Aerodynamics Institute, Mianyang, China

F. Tcheremissine  Dorodnicyn Computer Centre of RAS, Moscow, Russia

U. Teubner  Hochschule Emden/Leer, Institute for Laser and Optics, University of Applied Sciences, Emden, Germany

Institute of Physics, Carl von Ossietzky University of Oldenburg, Oldenburg, Germany

J. Thomas  Flow Research Unit, School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa

N. Tillmark  Mechanics, KTH—Royal Institute of Technology, Stockholm, Sweden

Maxim Teitel  IDF—Israel Defense Force, Jerusalem, Israel

Matt Trantham  Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA

Volkert Tritschler  Institute for Aerodynamics and Fluid Mechanics, Technische Universität München, Garching bei München, Germany

H. Tsuruta  Department of Aerospace Engineering, Nagoya University, Nagoya, Japan

Uri Tzadka  Civil Engineering Department, Shamoon College of Engineering, Beer Sheva, Israel

S. Udagawa  Tokyo Metropolitan College of Industrial Technology, Tokyo, Japan

T. Ukai  Institute of Fluid Science, Tohoku University, Sendai, Japan

S. Vaintraub  Soreq NRC, Yavne, Israel

S. Vaisakh  Department of Aerospace Engineering, Indian Institute of Technology Madras, Chennai, India

Marc Vandenboomgaerde  CEA-DAM, DIF, Arpajon, France

N.N. Vasilyev  Special Materials Corp., St. Petersburg, Russia

R.M. Vasu  Department of Instrumentation and Applied Physics, Indian Institute of Science, Bangalore, India

D.S. Vavilov  Institute for Problems in Mechanical Engineering, St. Petersburg, Russia

A. Vaynshtein  IARD Sensing Solutions LTD, Kibbutz Yagur, Israel

Justin L. Wagner  Sandia National Laboratories, Albuquerque, NM, USA

Z.A. Walenta  Department of Fluid Mechanics, Institute of Fundamental Technological Research, Polish Academy of Sciences, Warszawa, Poland
Contributors

**Minghu Wang** Advanced Propulsion Laboratory, University of Science and Technology of China, Hefei, China

**Xiansheng Wang** High Speed Aerodynamics Institute, China Aerodynamics Research and Development Center, Mianyang, China

**Z. Wang** Department of Aerospace Engineering, Nagoya University, Nagoya, Japan

**B. Wang** Department of Aerospace Engineering, Nagoya University, Nagoya, Japan

**Chris Weber** Lawrence Livermore National Laboratory, Livermore, CA, USA

**H. Wei** Centre for Hypersonics, School of Mechanical and Mining Engineering, The University of Queensland, St. Lucia, QLD, Australia

**Bernhard Weigand** Institute of Aerospace Thermodynamics, University of Stuttgart, Stuttgart, Germany

**A. Weiss** DLR Space Administration, Bonn, Germany

**C.Y. Wen** The Hong Kong Polytechnic University, Kowloon, Hong Kong

**Jackson Williams** Physics, Lawrence Livermore National Laboratory, Livermore, CA, USA

**Suthee Wiri** Southwest Division, Albuquerque, NM, USA

**Thomas Wofford** Southwest Division, Albuquerque, NM, USA

**Jens von Wolfersdorf** Institute of Aerospace Thermodynamics, University of Stuttgart, Stuttgart, Germany

**Yingchuan Wu** State Key Laboratory of Aerodynamics, China Aerodynamics Research and Development Center, Mianyang, People’s Republic of China

**L. Yaloz** Department of Structural Engineering, Ben-Gurion University of the Negev, Beersheba, Israel

**K. Yamada** Japan Aerospace Exploration Agency, Chofu, Tokyo, Japan

**Jiming Yang** Department of Modern Mechanics, University of Science and Technology of China, Hefei, Anhui, China

**Dangguo Yang** High Speed Aerodynamics Institute, China Aerodynamics Research and Development Center, Mianyang, China

**Xiangyu Yi** Department of Modern Mechanics, University of Science and Technology of China, Hefei, China

**Rachel Young** Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA

**H. Zare-Behtash** School of Engineering, University of Glasgow, Glasgow, Scotland, UK

**David E. Zeitoun** Aix Marseille University, Polytech Marseille, IUSTI/UMR CNRS 6595, Marseille, France

**Zhigang Zhai** Advanced Propulsion Laboratory, Department of Modern Mechanics, University of Science and Technology of China, Hefei, China

**Dongwen Zhan** Department of Modern Mechanics, University of Science and Technology of China, Hefei, Anhui, China

**Fu Zhang** Advanced Propulsion Laboratory, Department of Modern Mechanics, University of Science and Technology of China, Hefei, China
Hanxin Zhang State Key Laboratory of Aerodynamics, China Aerodynamics Research and Development Center, Mianyang, Sichuan, China

Z.J. Zhao Temasek Laboratories, National University of Singapore, Singapore, Singapore

C. Zheng Key Laboratory of Transient Physics, Nanjing University of Science and Technology, Nanjing, China

J.G. Zheng Temasek Laboratories, National University of Singapore, Singapore, Singapore

N.I. Zhigacheva Institute of Problems of Mechanical Engineering RAS, Saint-Petersburg, Russia

Yujian Zhu Department of Modern Mechanics, University of Science and Technology of China, Hefei, Anhui, China

Alex Zlatkis IDF—Israel Defense Force, Jerusalem, Israel

I.A. Znamenskaya Department of Physics, Moscow State University, Moscow, Russia