

DYMAT News

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Dear colleagues,

It is often easier to say what one intends to do than to do what one says. I wrote last year that we would publish three "DNews" each year, but the March 2008 issue has been cancelled. The reason is not a lack of technical matter, but only a lack of time! We apologize for this and will do our best to avoid this regrettable fact in the future.

Despite this difficulty, the Board continues to work with efficiency. The first version of the new website is now operating at the same URL www.dymat.org. We are working on the second version which will include active pages to order publications and register online.

In the last "DNews" we pointed out a new service of the Association which consists of providing financial support to scientific events within our topics of interest. This offer has been rapidly seized by several labs for the organization of workshops. For 2008, 4 requests have been received (and accepted by the Board) to support 2 workshops in France, 1 in Netherlands and 1 in Poland. This result is very encouraging and reinforces our idea to carry on in this way which corresponds really to promoting the objectives of the Association. All information concerning this is given on the website.

We are already preparing for the **DYMAT 2009** International Conference organized at the Royal Military Academy, Brussels, in September 2009 (see page 5), and in the shorter term, the **18th Technical Meeting** planned at Bourges at the beginning of September (see page 2). Notice that the Technical Meeting gives us also the opportunity to hold the **General Assembly**. I hope that there will be as many of you as possible at the General Assembly and that you will participate in the voting and election of half of the Board members. Remember that only registered members who have paid their annual subscription can attend the General Assembly and vote. Thus, if you have not done it renew your membership quickly! You will find the registration form on the website.

See you at Bourges.

Sincerely yours,
Richard Dorneval

■ THE 2008 MECADYMAT WORKSHOP

The annual MecaDymat Workshop (a joint meeting between the French association MECAMAT and DYMAT) was held at Lorient on April 2-3, 2008. It was organized by our colleagues from the University of "Bretagne Sud", and gathered 45 participants with 20 talks and two invited lectures focussed on geomaterials.



The oral presentations were mainly concerned with mechanical behaviour, over a large range of strain rates, of metallic and composite materials and to a lesser extent, concrete, polymers and foams. The presented works show an increasing link between experiments and numerical simulations. Moreover, one can notice a large tendency to develop varied experimental techniques, and particularly biaxial tests. High speed measurement of temperature is now available used very often in constitutive laws and the thermo-mechanical coupling under adiabatic conditions. The scale transition approach has been applied to viscoplasticity, damage and shock melting. Lastly, for the first time, work was presented on dynamic fracture mechanics of brittle materials under mode III.

This 2008 MecaDymat Workshop was very successful. All the attendees appreciated the scientific level of the presentations, the quality of the organization and the warmth of the welcome: many thanks to our colleagues from Lorient!

The 2009 MecaDymat Workshop will be organized at Bourges by "Ecole Nationale Supérieure d'Ingénieurs" (ENSIB).

DYMAT Association

CEA Centre de Valduc – 21120 Is-sur-Tille (France)
<http://www.dymat.org> – e-mail : enquiries@dymat.org



→ LIFE OF THE ASSOCIATION

■ 5th LIGHT WEIGHT ARMOUR GROUP WORKSHOP

Saint-Gobain IndustrieKeramik – Coburg (Germany)

This was the first Workshop to be held in a company as opposed to a university. The Company was Saint-Gobain in Coburg, who are very large ceramic manufacturers and amongst their products are body and vehicle armour.

Saint-Gobain were very kind to us and the meeting was very successful and interesting. Because the Workshop was held in a company, there were more papers from companies, which made for a good mix.



LWAG is taking a greater interest in armours and strengthening with nano-materials. This is wise because of the heightened risk of terrorist attacks in Europe. Also Body Armour was covered extensively for the first time as you can see in the list of presentations and one can feel it will become more important in future meetings.

People attending this Coburg Workshop came from: Holland, U.K., Germany, Czech Republic, Belgium and France.

We were taken on a visit of the Coburg factory where we saw the latest manufacturing techniques in operation for many different components.

The next Workshop will be at TNO near Delft on the 13th October next. In 2009 the Workshop will be at Aveiro University in May. Aveiro was where the first two workshops were held. Everyone is invited to either or both of these Workshops.

List of the presentations

- *SiC ceramic of Saint-Gobain* - Klaus Steuer
- *The ball on three ball test* - W. Harrer
- *New developments in Si3N4-SiAlON materials* I. Schulz
- *Spark Plasma Sintering: an emerging tool for the shaping of nanoceramics* - C. Estournes
- *The European Defence Agency (EDA)* - U. Karock
- *CNT as reinforcement for ceramics* - Jens Helbig
- *The effect of cracks on the ballistic performance of contoured protective body armour plates* - C. Watson
- *Military body armour* - P. Gotts
- *Ceramic protection against AP threats* - D. Galusek
- *Ballistic performance of aluminum and magnesium alloys* - E. Carto

Contact for information: **Bradley Dodd**
bradley.dodd@gmail.com

and LWAG website : www.lightarmour.org

■ CALL FOR MEMBERSHIP FEES

Don't forget to register for the DYMAT Association! The amounts for the two types of membership fee (one year or three years) are the following:

- Membership fee for **2008** only: **40 €**
- Membership fee for the period **2008-2009-2010**: **100 €**

Registered members (with the subscription in order) will find their **2008 membership card inside this DYMAT News**. Registration forms are available at www.dymat.org. If you have any questions don't hesitate to contact us at al.dymat@wanadoo.fr

■ WORKSHOP AT UNIVERSITY OF METZ

The first international workshop on the "numerical simulation of industrial processes" was held on November 2007 by the national school of engineers ENIM-Metz (France).

This event, supported by DYMAT, was organized in collaboration with the Laboratory of Physics and Mechanics of Materials (university of Metz), the University Carlos III of Madrid (Spain), and the University of Poznan (Poland), under Alexis Rusinek's chairmanship. 23 oral contributions were presented and 3 industrial researchers showed specific products in relation to the dynamic behaviour of materials: Cenaero, Cedip and Polytec.



In the evening a banquet was organized which facilitated exchanges and discussion in a relaxed atmosphere.

During the concluding remarks the next workshop at Poznan (Poland), on September 2008 was announced: the general topic concerns the dynamic rupture of ductile and brittle materials applied to industrial processes. (<http://ikb.poznan.pl/workshop2008/>).

Alexis Rusinek
rusinek@pmm.sciences.univ-metz.fr

■ 18th DYMAT TECHNICAL MEETING
 Bourges (France), Sept. 10-12, 2008

The goal of the 18th DYMAT Technical Meeting is to exchange recent progress in the study of the dynamic behaviour of novel functional materials such as bulk nanomaterials and bulk metal glasses (BMGs).



The conference will cover theoretical, experimental and numerical approaches to the dynamic mechanical behaviour of bulk nanomaterials and BMGs. The presentations will provide a complete description of the material

processes and of the microstructural and conventional mechanical properties of the studied materials.

DYMAT 18th Technical Meeting 2008

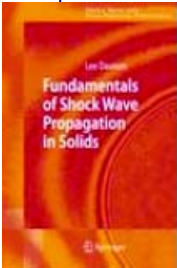
Nexter Munitions - D21/MMU
 7 route de Guerry
 18023 Bourges Cedex (France)

email: 18dymat@nexter-group.fr
 website: www.dymat.org

■ BOOK INFORMATION

■ **Fundamentals of Shock Wave Propagation in Solids**

by Lee Davison
Series: Shock Wave and High Pressure Phenomena
Springer 2008. – www.springer.com



This book forms an introduction to important aspects of shock-wave propagation in solid materials. Emphasis is on the regime of moderate compression that can be produced by high-velocity impact or detonation of chemical explosives.

The book includes a careful account of the kinematical and dynamical equations of the subject along with constitutive equations that describe the distinguishing responses of compressible fluids, elastic solids, and elastic-

plastic and elastic-viscoplastic solids. The text includes numerous exercises and detailed solutions to these exercises.

■ **Shock Wave Science and Technology Reference Library**

Vol. 1 - Multiphase Flows (2007)
M.E.H. van Dongen

This volume treats shock and expansion waves in complex, bubbly liquids and cryogenic liquids, and examines the relationship of shock waves with - phase transitions as well as their interaction with solid foams, textiles, porous and granular media.



Vol. 2 and Vol. 3 – Solids (2008)
Yasuyuki Horie

Springer. – www.springer.com

These volumes are primarily concerned with high-pressure shock waves in solid media, including detonation, high-velocity impact and penetration events.

In the 3 volumes all chapters are each self-contained, and can be read independently of each other, though they are of course thematically interrelated. They offer a timely reference, for beginners, as well as professional scientists and engineers, on the foundations of shock waves in solids with new viewpoints, and on the burgeoning developments.

■ **Introduction to experimental techniques for materials testing at high strain rates**

by Janusz R. Klepaczko
Institute of Aviation Scientific Library,
<http://www.ilot.edu.pl>

This book is a practical, systematic and concise introduction to the study of materials behaviour under high strain rate conditions. It is featuring an extensive examination of numerous experimental techniques: it can be a source to the work of engineers, material scientists and students.

Order directly from the Institute of Aviation
Attn. Mrs. Iwona Olesinska
Al. Krakowska 110/114
02-256 Warsaw (PL)
olesinska@ilot.edu.pl



■ THESES

Olivier Lurdos

(contact: montheil@emse.fr)
“Constitutive laws and dynamic recrystallisation: empirical and physical approaches”
Ecole des Mines de Saint-Etienne (France), Apr. 2008

Matthieu Mazière

(contact: matthieu.maziere@ensmp.fr)
“Burst of turboshaft disks”
Ecole des Mines de Paris (France), Nov. 2007

Shirley Kalamis Garcia Castillo

(contact: rzaera@ing.uc3m.es)
Analysis of preloaded composite laminates subjected to impact loads
University Carlos III of Madrid (Spain), 2008

Julien Roger

(contact: eric.markiewicz@univ-valenciennes.fr)
“On the investigation of experimental and numerical methods to characterise the fracture behaviour of epoxy resins: an approach to prevent failure in electronic component”
University of Valenciennes (France), Dec. 2007

Remy Delille

(contact: eric.markiewicz@univ-valenciennes.fr)
“Contribution to a better understanding of human skull bone's mechanical behaviour, subjected to various means of conservation and loading”
University of Valenciennes (France), Dec. 2007

Pierre Mahelle

(contact: eric.markiewicz@univ-valenciennes.fr)
On the investigation of experimental and numerical behaviour of spot-welded assemblies submitted to quasi-static and dynamic loadings
University of Valenciennes (France), Dec. 2007

■ DATA BASE FOR EQUATION OF STATE

A new web site has been created on equations of state theory and modelling, along with various applications. It includes tutorials, publications, and a weblog. If you are interested, you can find it at the URL:

<http://kerleytechnical.com>

■ NEW REVIEW

Bentham Science Publishers announce the launch of a new expert review journal:

RECENT PATENTS ON MATERIAL SCIENCE

The journal is essential reading for all researchers involved in material science, nanotechnology, computer and engineering sciences.

Information: www.benthamscience.org/mats

■ STILL ON THE WEB

If you are interested in the fundamentals of ballistics (internal, external or terminal ballistics) and its applications, you might be interested in the electronic book and the associated software written about ballistics. The “fundamentals of ballistics” electronic book has been active for almost a year now, and we have registered readers from more than 40 countries! For more information, please visit

<http://users.telenet.be/gd/ballistic.htm>,

and become a registered reader. Registration is free.

→ OBITUARIES

■ WITH SADNESS

■ Obituary of Dr David Gorham

David Gorham died on the 6th December 2007 at the age of 60. He will be known by many DYMAT members for his research on impact, fracture, erosion, comminution, and for the development of various techniques in the high strain rate area. He was elected to the Governing Board of DYMAT in 1991 and served until 1995 as deputy Secretary.

David came to Trinity College, Cambridge in 1966 to study Physics, and I was delighted when he chose to do a PhD on the impact response of fibre composites. Subsequently he stayed on as a Post-Doc and Research Associate to develop a Hopkinson pressure bar system for studies of the dynamic properties of materials.

In 1979, he moved to the Open University. After an initial period when he was heavily involved in course-work, he returned to research in 1981 performing further studies of dynamic material properties, some semiconductor projects, and new topics such as particle impact and comminution.

His early research at the Cavendish on the impact response of composites was noteworthy for identifying failure mechanisms, often aided by high-speed photography. This was a period when my research group acquired image converter cameras (such as the Imacon) which could record pictures at rates up to 20 million per second. David was particularly good at producing high quality pictures using shadowgraph, schlieren, and photoelastic techniques.

Some of his best research was with Hopkinson bars. He developed a miniaturised system (bars 3mm in diameter) for investigating specimens as small as 1mm diameter to produce strain rates close to 10⁵ s⁻¹ (the practical limit for Hopkinson bar systems). Good eyesight was a pre-requisite for attaching the semiconductor strain gauges to the bar! Additionally he showed that by viewing the specimen through a glass wedge you can optically remove the middle part of the disc so that the camera just records the edges. This allows the magnification to be increased by a factor of up to 10x so that plastic waves passing through the specimen in high velocity impacts could be observed. David also studied the dispersion of elastic waves in the bar and quantified the effects of interfacial surface roughness, friction and inertia in the specimen. He was effectively the UK expert in such studies.

At the Open University he studied, with A.D. Salman and A.H. Kharaz, the rebound of particles and the way they fail during impact. In total he published 40 papers (a full list can be obtained from me if required).

David was a very innovative scientist who was particularly good with electronics and optics. He is remembered at Cambridge for both his research and the way he helped others.

Our thoughts are very much with his wife Sue, and children Sarah, James, and Ruth.

Professor John E. Field
Cavendish Laboratory
University of Cambridge

■ Death of Anatoly N. Dremin

Anatoly Dremin, a prominent experimenter, theorist ("Toward Detonation Theory"), and frequent contributor to international meetings, died on Jan 12. Dremin worked at the former Institute of Chemical Physics (Chernogolovka, Russia) and his scientific contributions include the development of the electromagnetic gauge method of particle velocity measurement, application to measurements of shock and detonation structure in solids, chemical synthesis with shock waves, experiments and theory for initiation and critical diameter effects in high explosives. Dremin's theory of detonation wave "breakdown" proposes that unstable detonation wave propagation in solid explosives is sustained by the collision of transverse waves creating hotspots that continuously re-initiate reaction along the front. A full obituary appears in *Propellants, Explosives, Pyrotechnics* 33, No. 2 (2008).

■ Obituary of Barry Goldthorpe

It is with great sadness that we announce the death, last year, of **Barry Goldthorpe** after a long illness.

Barry worked for most of his career at Fort Halstead in the UK initially as part of the MOD research establishments and latterly in QinetiQ. Barry was particularly noted for his work on material and fracture algorithms, particularly for metals. He developed novel analytic techniques to solve the equilibrium conditions under complex tensile stress-states and thus was able to relate conditions in the neck back to a uniaxial stress state, for much more severe necks, where the standard correction terms broke down. This allowed a much greater insight into the physical deformation and fracture mechanisms and allowed the development of pragmatic physically based models where all the constants were measured directly from standard material tests (i.e. tension and compression). He utilised these techniques in combination with hydrocode modelling to develop a generalised path dependent algorithm that could be applied directly to any path dependent process.

In terms of fracture Barry further extended the path dependent approach to develop a very elegant and predictive algorithm for ductile void growth, nucleation and fracture. This was a completely novel approach, published in DYMAT 97, in that the method worked backwards from the point of fracture in a Quasi-static tensile test. This had the great advantage that the precise conditions at fracture could be calculated very accurately and related back to uniaxial stress and thus there was no pre-assumption of initial void volumes. These models have been extensively validated via plate impact spall tests, Taylor tests and fracture cylinders for a range of materials.

Barry's models have been successfully implemented into Euler and Lagrange hydrocodes and have demonstrated a predictive capability for a wide range of problems involving dynamic loading conditions. Furthermore they have been used for a range of 2D and 3D applications concerning structural integrity and fragmentation. Without Barry's novel insight into the complex physical mechanisms, this capability would not have been possible.

Barry was a very modest person with a pleasant personality and will be sadly missed by all. He is survived by his wife and children.

Phil Church
QinetiQ

→ WORKSHOPS and CONFERENCES

■ CONFERENCES*

✓ International Congress on Theoretical and Applied Mechanics
ADELAIDE (Australia) – August 24-30, 2008
www.prandtl.maths.adelaide.edu.au/ictam2008/

✓ Dynamic fracture and damage of brittle and ductile materials and its industrial applications
POZNAŃ (Poland) – September 3-5, 2008
<http://www.ikb.poznan.pl/workshop2008>

✓ 5th International Conference on Fracture of Polymers, Composites and Adhesives
LES DIABLERETS (Switzerland) – September 7-11, 2008
www.tc4pca.elsevier.com

✓ 18th DYMAT Technical Meeting
Dynamic Mechanical Properties of Nanomaterials and Metallic Glasses
BOURGES (France) – September 11-12, 2008
www.dymat.org

✓ 24th International Symposium on Ballistics
NEW ORLEANS, Louisiana (USA) – September 22-26, 2008
www.ndia.org (events & meetings)

✓ 25th Danubia-Adria Symposium on Advances in Experimental Mechanics
CESKE BUDEJOVICE & CESKY KRUMLOV (Czech Republic)
September 24-27, 2008
<http://danubia-adria.cz>

✓ ARA
Aeroballistic Range Association Annual Conference
CAPETOWN (South Africa) – October 6-10, 2008
www.aeroballistics.org

✓ Time Dependent Behaviour of Rubber
LONDON (UK) - October 30, 2008
mpburke@qinetiq.com

✓ AMPT-8
Advances in Materials and Processing Technologies conference
MANAMA (Kingdom of Bahrain) – November 2-5, 2008
www.ampt2008.com

✓ ICHSIP28
28th International Congress on High-Speed Imaging and Photonics
CANBERRA (Australia) – November 9-14, 2008.
<http://ichsip28.unsw.adfa.edu.au>

✓ Plasticity 2009
International Symposium on Plasticity and Current Applications
Special Session on "Strain Rate Effects in Polymers
ST. THOMAS (Virgin Islands, USA) – January 3-8, 2009
<http://www.internationalplasticity.com/indexST2.html>

✓ APS – SCCM
Topical Conference on Shock Compression of Condensed Matter
Nashville, Tennessee (USA) – June 28-July 3, 2009
Contacts: wgp1000@cam.ac.uk, mdfurni@sandia.gov or wvanderson@lanl.gov

✓ DYMAT 2009
9th International Conference on the Mechanical and Physical behaviour of Materials under Dynamic Loading
BRUSSELS (Belgium) – September 7-11, 2009
www.dymat2009.org

**in red letters are new announcements with respect to the last DYMAT News*



■ DYMAT 2009 INTERNATIONAL CONFERENCE – BRUSSELS (BELGIUM) – SEPTEMBER 7-11, 2009

The objective of the triennial international DYMAT conferences is to create a forum where people involved in the scientific research or the industrial applications related to the dynamic behaviour of materials can meet and discuss results and ideas by means of a series of presentations (oral and poster) and a small-scale technical exhibition. All nations, European as well as non-European, are invited to attend the conferences and to offer contributions.

The topics presented at the DYMAT conferences cover theoretical, numerical and experimental approaches to the various methods used to study the mechanical and physical behaviour of metals, ceramics, polymers and composites at high strain rates. People are also invited to present work based on specific industrial applications (the dynamic behaviour of materials is relevant in a multitude of situations ranging from automobile crashes and terminal ballistics to space exploration). Along with the traditional DYMAT conference themes, the organizers of DYMAT 2009 would also like to set up two special sessions, the first one covering novel experimental techniques, the second one dealing with practical applications related to bio-mechanics.

31 Oct 2008	Abstracts due
30 Nov 2008	Authors notified
01 Jan 2009	Start of registration
31 Jan 2009	Papers due
30 Jun 2009	End early registration
31 Aug 2009	End of registration
07 Sep 2009	Start of conference

abstracts due by October 31st, 2008

www.dymat2009.org
e-mail dymat2009@rma.ac.be

→ LABS

■ THE “STRUCTURAL MECHANICS CAD LABORATORY” of the POZNAŃ UNIVERSITY of TECHNOLOGY

by Tomasz Lodygowski and Adam Glema
 contact: Tomasz.Lodygowski@put.poznan.pl



Poznan University of Technology, with a total of 20,000 students, more than 1200 academic staff and 9 technical departments, belongs to the biggest technical universities in Poland. The Department of Civil and Environmental Engineering consists of 3 Institutes. One of them is the Institute of Structural Engineering which has about 100 employees (about 70 are academic staff). Every year about 450 students present their final master of science, diploma theses prepared under the supervision of the academics from ISE. This requires the existence of both laboratories and libraries.

The team of the **Structural Mechanics CAD Lab** collects scientists interested in understanding the mechanical response of materials and systems to impact loading.

The research is based on advanced experimental evidence and is concentrated on detailed theoretical and numerical modelling of dynamic material properties in elastic, plastic and softening regime through localization phenomena including brittle as well as ductile fracture. Advanced modelling methods with formulation and programming of physical relations provide the means for close integration of corresponding experimental and numerical methods. An integrated experimental-numerical approach to understand underlying phenomena at different length scales and processes instances have been adopted and are being addressed to engineers, material scientists, physicists and mathematicians within the similar research. Short process time and intensity of state variables evolution makes necessary to observe space and time increases with the consideration of finite velocity of phenomena propagation and development. The point of interest is the velocity of defects (cracks, voids) evolution. The isotropic and anisotropic character of damage and fracture is taken into account. Loading conditions and recreation of initial and boundary conditions within the experimental tests are under crucial attention.

The team currently consists of 2 academic members, 3 post-doctoral researchers and 4 PhD students, and is part of the Institute of Structural Engineering of Poznan University of Technology. The team actively collaborates with several academic and industrial partners in Poland, France and US interested in research on subjects of high strain rate phenomena.

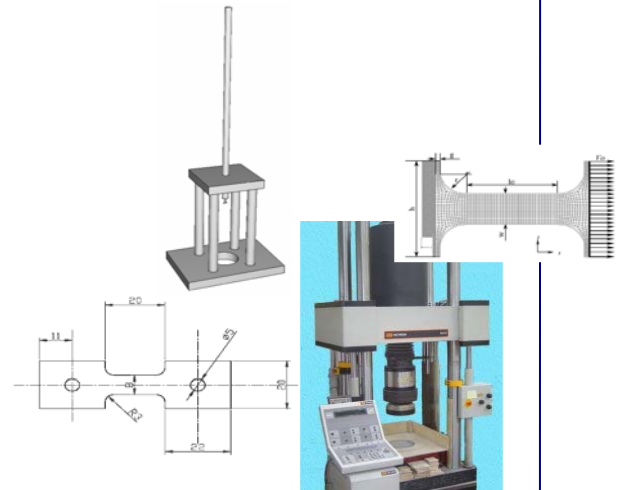


Figure 1 - Testing machine for metal specimen in tension with optimization of specimen for dynamic tension and modification for medium speed loading tests.

PRESENT CAPABILITIES INCLUDE:

✓ **Experimental Characterisation**

- Instron 8500 Plus with measurement instruments:
 - Hottinger Baldwin Messtechnik MGC plus
 - Static/Dynamic loading 1000 / 500 kN
- Static and dynamic **compression tests**
- Static and dynamic **three point bending**

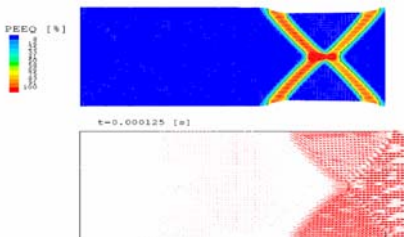
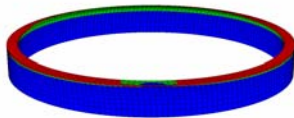


Figure 2 - Numerical simulation of metal specimen under impact torsion (upper) and tension (lower)

✓ **Modelling**

- **Areas of interest**
 - Constitutive modeling
 - Thermo-visco-plasticity, biomechanics, acoustics
 - Wave effects,
 - Localization, failure and fracture in brittle and ductile materials
 - Contact mechanics
- **Methodologies**
 - Finite Element modeling
 - Optimization and Sensitivity
 - Multiscale modeling
 - Neural and genetic methods
- **Software**
 - ABAQUS, FEsafe, ROBOT

