

〈 オープンセミナー 'Dynamic Material Behavior' のご案内 〉

2006 年 6 月

各 位

拝啓

貴下、益々ご清栄のこととお喜び申し上げます。

さて、この度、“Dynamic Material Behavior by Prof. Dr. Werner Riedel”と題し、主に凝縮相の衝撃現象の物理を話題とするオープンセミナー（詳細については、添付の「セミナー概要」を参照下さい。）を開催することとなりました。講師は、今年の 4 月から 8 月末までの予定で、応用セラミックス研究所に客員教授として来日している Werner Riedel 氏です。Riedel 氏は、ドイツの NPO である Fraunhofer 協会に属する研究所の一つ、Ernst Mach Institut (EMI) でこの 3 月まで“Material Dynamics”の部門長を務めていました。（氏の略歴・業績については、添付の「略歴&業績」を参照下さい。）

衝撃分野でも、気相中の衝撃波に比べ取分け凝縮物質中の衝撃現象に関する教育は、日本の大学教育からほぼ完全に欠落しており、これまでその必要性を痛感して参りました。当該分野における米国とロシアの圧倒的優位は明らかです。その中であって、EMI は大小 7 機の二段式軽ガス銃を保有するなど、エルンスト・マッハの名を襲う研究所にもかかわらず、気相よりも寧ろ凝縮相の衝撃波研究の一大中心として知られています。講義は英語で行われ、広く一般の方にも公開致します。本分野にご興味のある方をお誘い合わせの上、是非、本オープンセミナーにご参加下さいますようお願い致します。

以上、謹んで書面にてご案内申し上げます。

敬具

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(世話役) 客員教授 片 山 雅 英

東京工業大学応用セラミックス研究所主催オープンセミナー

— “Dynamic Material Behavior by Prof. Dr. Werner Riedel” —

協賛： 日本衝撃波研究会、火薬学会、CRC ソリューションズ

日時： 2006 年 7 月 11 日(火)10:00～17:00、12 日（水）、09:30～17:00

場所： 東京都港区芝浦 3-3-6 田町キャンパス（JR 東日本 山手線/京浜東北線 田町駅前）
イノベーションセンター9F913 号室階段教室

参加費： 無料

懇談会： 2006 年 7 月 11 日 17 時 15 分から 8F805 号室にて

（懇談会費：一般 5,000 円、学生 3,000 円）

オープンセミナー世話役： 応用セラミックス研究所 客員教授 片山 雅英
セミナー内容に関するお問い合わせは片山 雅英(m-kata@crc.co.jp)まで。

参加申し込み： 2006 年 7 月 5 日(水)共同利用・研究支援室 森島 順子までメールにて。
（森島順子 045-924-5968 kenkyushien@msl.titech.ac.jp）

[但し、定員の 50 名に達し次第締め切ります。]

※：添付の MS-Word 形式の申込書をご使用下さい。お申し込みの際、懇談会へのご出欠、または懇談会のみご出席等も併せてお知らせ下さい。

田町キャンパスのイラスト



[講演内容]

Course on Dynamic Material Behavior

INTRODUCTION AND MOTIVATION

Fraunhofer Society, Ernst-Mach-Institute, presenter

Classification of dynamic material behaviour in automotive, military and space applications

STRAIN RATE DEPENDENT STRENGTH

- elasticity, plasticity across the strain rate regime
- stress wave experiments to determine dynamic strength
High-speed tension, Hopkinson-Bar experiment; Taylor-Test
- constitutive models of dynamic deviatoric strength

SHOCK WAVES

- Theory of shock waves and equation of state for materials
- Shock wave experiments to derive dynamic materials behaviour
plate impact, contact detonation, laser shock
phenomena of release and spallation

THEORY OF HYDROCODES

- Fundamental Equations
- Discretisations
- Choice of description for different applications classes

DYNAMIC BEHAVIOUR AND MODELLING OF CHOSEN MATERIALS

- high strength steel
- concrete:
heterogeneity, porosity, damage
- composites:
equation of state and orthotropic materials, fibre failure and delamination
characterisation

The presentation units will be accompanied by exercises considering practical examples and questions in dynamic material analysis.

Werner Riedel
Dr.-Ing., Visiting Professor

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Education:

1989 High school degree (Abitur); Ingolstadt, Bavaria, Germany;
 1994 Full degree in mechanical engineering (German 'Diplomingenieur'), speciality:
 research and development; Polytechnical University of Munich (TUM);
 1995 Diplôme d'Etudes Approfondies (French master's degree) on numerical methods
 in engineering at Université de Technologie de Compiègne, France;
 1996 10 months compulsory military service
 since 9/1996 Scientist at Ernst-Mach-Institute (EMI), Fraunhofer Society for Applied Research,
 Freiburg; Department of Numerical Simulation
 2000 Dissertation (Dr.-Ing.) at University of Armed Forces at Munich.
 Topic: Finite Element Modeling of Concrete under Dynamic Loading;
 2001 Fraunhofer management course for future leaders

Professional Experience:

1990-1996 industrial internships and employments in parallel to university studies:
 AUDI AG, Daimler-Benz Aerospace, Mißlbeck AG, Schubert&Salzer
 since 9/1996 at Ernst-Mach-Institut:
 04/2001 Head of R&D group 'Dynamic Material Characterization'
 01/2003 Deputy head of department 'Material Dynamics'
 01/2004 Head of department 'Material Dynamics' supervising 22 full time employees
 04/2006 Visiting Professor at Tokyo Institute of Technology, Japan

Languages:

English, French (German as native speaker)

Yokohama, June 2006

Publications:

1. Hiermaier S., Riedel W., Numerical Simulation of Failure in Brittle Materials using Smooth Particle Hydrodynamics, International Workshop on New Models and Numerical Codes for Shock Wave Processes in Condensed Media, St. Catherine's College, Oxford, UK, 15-19 Sept. 1997 pp. 505-518
2. K. Thoma, W. Riedel, H. Nahme, B. Lexow, E. Straßburger, H. Senf, Shock Wave Phenomena in Concrete – Impact Tests and Mesomechanical Simulations, Transient Loading and Response of Structures, Int. Symposium honouring Mr. Arnfinn Jenssen, Trondheim, 25. bis 27. Mai 1998
3. W. Riedel, K. Thoma, S. Hiermaier, Beton unter dynamischer Beanspruchung, Materialmodellierung, Messung von Parametern und numerische Simulation, X. Forum Bauinformatik, Bauhaus-Universität Weimar, September 1998
4. C. Hayhurst, S. Hiermaier, R. Clegg, W. Riedel, M. Lambert, Development of Material Models for Nextel and Kevlar-Epoxy for High Pressures and Strain Rates, Int. Jn. Impact Engn. 1999
5. Riedel W., Thoma K., Hiermaier S., Schmolinske E.: Penetration of Reinforced Concrete by BETA-B-500, Numerical Analysis using a New Macroscopic Concrete Model for Hydrocodes. Proc. (CD-ROM) 9. International Symposium Interaction of the Effects of Munitions with Structures', Mai 1999
6. K. Thoma, W. Riedel, S. Hiermaier: Mesomechanical Modeling of Concrete Shock Response, Experiments and Linking to Macromechanics by Numerical Analysis, European Conference on Computational Mechanics, September 1999
7. K. Thoma, W. Riedel, F. Schäfer, S. Hiermaier, Status and Perspectives in Protective Design, Int. Jn. Space Debris 2, 201-224, 2000
8. W. Riedel, E. Straßburger, B. Lexow, H. Nahme, K. Thoma, Fragment impact on bi-layered light armours- experimental analysis, material modeling and numerical studies, 19th International Symposium on Ballistics, May 7 to 11 2001, Vol. III, pp. 1393
9. W. Riedel, K. Thoma, A. Kurtz, P. Collins, L. Greaves, Vulnerability of Composite Aircraft Components to Fragmenting Warheads - Experimental Analysis, Material modeling and Numerical Studies 20th International Symposium on Ballistics, September 23 to 27 2002, pp. 702
10. Welle M., Riedel W., Hiermaier S., Thoma K., Characterisation and Modelling of a Bi-Layered Polymer Material, Proc. 14th DYMAT Technical Meeting, Nov. 2002, S. 205 ff
11. R.A. Clegg, D.M. White, C.J. Hayhurst, W. Riedel, W. Harwick, S. Hiermaier, Advanced Material Models and Material Characterisation Techniques for Composite Materials subjected to Impact and Shock Wave Loading, Journal de Physique, 2003
12. W. Riedel, K. Weber, K. Thoma, J. Färber, Reduction of Fragment Effects behind Layered Armour - Experimental and Numerical Analysis, 21st Int Symp. Ballistics, April 2004
13. R. Sindelar, W. Riedel, R. Schauble, B. Thielicke, S. Hiermaier, Failure Mechanisms in Layered Composite Materials for Compressed Hydrogen Tanks, FISITA World Automotive Congress, May 2004
14. S. Ryan, W. Riedel, F. Schäfer, Numerical Study of Hypervelocity Space Debris Impacts on CFRP/AL Honeycomb Spacecraft Structures, International Astronautical Congress, Vancouver, 2004
15. R. A. Clegg, D. M. White, W. Riedel, W. Harwick, Hypervelocity Impact Damage Prediction in Composites Part I - Material Model and Characterisation, accepted for Int. Jn. Impact Engn, 2005
16. W. Riedel, H. Nahme, , Hypervelocity Impact Damage Prediction in Composites Part II – Experimental Investigations and Simulations, accepted for Int. Jn. Impact Engn, 2005

Examples of R&D Projects:

Development of Material Models in Finite Element Codes

- Concrete under Dynamic Loading (PhD thesis); Developer of the RHT concrete model implemented as standard in AUTODYN™ since 2000; used internationally by renowned establishments: FOI defence agency Sweden, Sandia National Laboratories US, German Armed Forces Technical Centres
- Composites models for space protection shields: Advanced Damage Models for Numerical Simulations Codes, Contract with European Space Agency ESA, No. 12400/97/NL/PA, 2001 to 2004; manager of joint project with Century Dynamics, UK

Modelling of Crashworthiness for Automotive Industry

- Characterisation and Modelling of a Structural Polymer Material, EMI report I 36/02, for BMW, 2001
- B.Boschet, W. Riedel, Modelling the BAYPREG-F® Sandwich for Crashworthiness Simulations, EMI reports I 64/05 for Bayer Material Science, 2005
- Dynamic Failure of a Carbon Fibre high-pressure Hydrogen Storage Vessel; Development of a Numerical Model and Experimental Validation; project for a global car manufacturing company started in 2004

Vulnerability of Composite Aircraft Components

- Numerical (and Experimental) Studies on Hydraulic Ram Effects in a Composite Wing Section, EMI-Report I 89/02, for EADS Military Aircraft, Germany, 2002
- Air Senior Representatives LTTP 'Aircraft Survivability Technologies', key contributions to US-GB-F-D cooperation, composite characterisation and numerical simulations, funded by German MoD (ref. 9)