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ICF8 - an Important Event in the Scientific Life of Ukraine

The 8th International Conference on Fracture - ICF8 - was held in Kiev in Ukrainein June 1993. The conference was co-sponsored by ESIS owing to the extreme difficult situation in which the organisers had to operate. This situation has also caused the following report, received from Prof. O.Ye. Andreykiv (Secretary of ICF8 Programme Committee) and Dr. N.V. Kuznyak, Secretary of ICF8 Organising Committee) to be somewhat late.

Two of the ICF8 officers, Prof. V.V. Panasyuk (left) and Dr. N.V. Kuznyak, finally able to relax during the Conference banquet

The 8th International Conference on Fracture (ICF8) organised by the Academy of Sciences of Ukraine and the International Congress on Fracture (ICF), is undoubtedly the most significant international event in Ukrainian science over the past 5-10 years.

The conference was held from 8-14 June, 1993 in Kiev, the capital of Ukraine. This was the first time an ICF conference had been held in Eastern Europe. The International Conferences on Fracture are quadrennial events organised by ICF. The "Olympic Games" of fracture mechanics were previously held in Sendai (1965, Japan), Brighton (1969, UK), Munich (1973, Germany), Waterloo (1977, Canada), Cannes (1981, France), New Dehli (1984, India), and Houston (1979, USA). At ICF7 bids were made by several internationally known scientific centres to hold the next Conference in their country. Among them were Kiev (Ukraine), Sidney (Australia) and Dublin (Ireland). In view of the vigorous activities of Ukrainian scientists and their prominent achievements in the field of metals fracture the staging of this significant world event was entrusted to the Ukrainian Organising Committee headed by Prof. V.V.Panasyuk, Director of the Physico-Mechanical Institute of the Academy of Sciences of Ukraine.

Owing to the changes which have occurred in the political system and economic life of Ukraine, the ICF8 Organising Committee had to overcome many different obstacles. Moreover, the organisers had to contend with the prejudices of some overseas scientists who thought that ICF8 could not be successfully held in Ukraine. Our thanks must be expressed to ESIS, one of the ICF8 sponsors, its leaders, the chairmen and members of committees: Dr. I. Milne, ESIS President, Prof. A. Bakker, ESIS Secretary, Prof. K.J. Miller, "FFEMS" Editor-in-Chief, Prof. D. Firrao, Prof. D. Francois, Prof. J.F. Knott, Prof. K.H. Schwalbe, Prof. M.O. Speidel. They provided support to the ICF8 National Committee, invited prominent European scientists in the field of fracture mechanics to participate in ICF8 and established their own friendly contacts with Ukrainian scientists, all of which helped to make ICF8 a success.

The total number of participants was more than 550, among them 159

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overseas participants from 30 countries: 20 from Germany, 18 from the USA, 17 from France, 15 from the UK, 12 from India, 11 from P.R.China, 7 from Japan, etc. Ukraine was represented by 240 scientists, Russia by more than 150. The working language of the conference was English.

The first plenary meeting of the Conference was of particular, even ritual significance. It was held in the Conference Hall of Kiev Polytechnic Institute. Prof.V.V. Panasyuk, Chairman of the ICF8 Ukrainian National Organising Committee, delivered his welcome address and presented a mace, as a symbol of the highest power in Ukraine, to Prof.P. Rama Rao, ICF President. Prof.P. Rama Rao welcomed the participants of ICF8 and declared the Conference open. Then the The Vice-President of Ukraine Prof.M. Zhulinski, then read a welcome address by the President of Ukraine, L.M. Kravchuk, to the participants of ICF8. The President of the Academy of Sciences of Ukraine, Prof.B.Ye. Paton, and the Rector of Kiev Polytechnic Institute, M. Zgurovsky, also addressed the delegates.

The ICF8 Honorary Lecture by Prof. V.V. Panasyuk was delivered at the first plenary meeting. It was devoted to the development of deformation criteria in fracture mechanics.

Ukrainian scientists, Prof. Panasyuk's school in particular, have obtained world recognition in this field. The A.A.Griffith Memorial Lecture was presented by Prof. J.F. Knott, a foreign member of the Academy of Sciences of Ukraine.

In accordance with the Programme, the Conference continued its work in 10 sections. In addition there were well attended round table discussions on:

- "Education and training in strength and fracture";
- "Interrelation between Macro- and Micromechanics of Fracture";
- "Problems of Aircraft Ageing",

The last theme attracted the greatest attention. In particular, Prof. M.L. Williams stressed that ICF supports the exchange of scientific information among researchers and engineers engaged in the field of fracture mechanics. Aircraft ageing and resource prediction are problems of great urgency, but similar problems exist in other fields of engineering. The determination of this problem and its understanding by investigators and engineers were discussed, including the design principles and correctness of data processing methods. Data from exploitation experience under environmental effects were also given.

More than 700 papers were presented at the conference, including nearly 100 by invitation (10 papers for each section).

In spite of economic difficulties ICF8 was well organised. The delegates were located in the "Pushcha Ozerna" sanatorium in a uniquely picturesque part of Kiev. It provided perfect conditions for the work of the numerous sections and the combined plenary meetings. All ICF8 participants received souvenir bags containing symbolic and scientific material depicting the role of Ukrainian science in this branch of knowledge, together with other ICF8 material.

Meals and entertainment were well organised. Among the evening arrangements there was an interesting and successful meeting of conference participants, with a presentation of Ukrainian scientific societies. Co-organisers of this meeting were the ICF8 National Organising Committee (Prof. V.V. Panasyuk), the Science and Culture Committee on Relations with Ukrainians Abroad, affiliated to the Academy of Sciences of Ukraine (Prof. S. Yatskiv), Shevchenko Scientific Society (Prof. O. Romaniv) and the Association of Ukrainian Electric Welders (Prof. S. Kucher-Yatsenko). Shevchenko Scientific Society prepared a unique information document in English (editor - Prof. O.M. Romaniv) "Investigations of Materials Strength, Fracture and Integrity. View from East Europe". The publication provides an analysis of the considerable success of Eastern European scientists in the field and their contribution to the development of solutions to this problem.

A special issue of the "Fizyko-Chimichna Mechanika Materialiv" journal was prepared for the ICF8 participants. It was dedicated to the A.A. Griffith centenary. The papers by well-known scientists in the field of materials fracture and structural integrity were published n English.

The Conference provided an overview of the significant achievements of world science on materials fracture and structural integrity with Ukraine among the leaders.

ICF8 created a real basis for the establishment of scientific contacts and co-operation between scientists from different countries. Ukrainian science was worthily represented in this field of knowledge, thus promoting its consolidation in the world scientific process.

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ESIS Technical Committee 9 on

Concrete

Minutes of the 3rd Meeting held in Brisbane, Australia, on September 20, 1993.

The meeting was attended by 14 people from 9 different countries: J.H. Andreasen (Denmark), G.I. Barenblatt (U.K.), A. Carpinteri (Italy), L. Elfgren (Sweden), R. Gettu (Spain), C. Huet (Switzerland), B.L. Karihaloo (Australia), D. Lange-Kornbak (Australia), J. Planas (Spain), P. Rossi (France), J. Rots (Netherlands), J.P. Ulfkjaer (Denmark), S. Valente (Italy), J. van Mier (Netherlands).
The minutes of the 2nd Meeting (Vienna 1992) are approved.
After approval of the minutes of the 2nd meeting, the Chairman presented the final version of the Round Robin "Scale effects and transitional failure phenomena of reinforced concrete beams in flexure". This forms the result of all suggestions coming from the members of the Committee. Eight Laboratories stated their intention to participate in the Round Robin:

- University of Aalborg - Denmark (Dr. J.P. Ulfkjaer)
- Universitat Politecnica de Catalunya - Spain (Dr. R. Gettu)
- Universiteit Gent - Belgium (Dr. L. Taerwe)
- Universidad Politecnica de Madrid - Spain (Prof. M. Elices)
- University of Sydney - Australia (Prof. B.L. Karihaloo)
- Universität Stuttgart - Germany (Dr. J. Ozbolt, Prof. R. Eligehausen)
- TNO Building and Construction Research - The Netherlands (Dr. J.G. Rots)
- Politecnico di Torino - Italy (Prof. C. Bosco, Prof. A. Carpinteri).

The Committee expressed the intention to conclude the first part of the Round Robin, related to the normal strength of concrete, within the next Academic Year 1993-94, and, possibly, the global testing program within the Academic Year 1994-95.
The final version of the Round Robin was extensively discussed by the participants, together with the possible involvement of additional Laboratories (Elfgren, Huet, Rossi).
The Chairman informed the attendants that the next IUTAM Symposium on Micromechanics will be held in Torino, Italy, on October 3-7, 1994, with the title "Size-Scale Effects in the Failure Mechanisms of Materials and Structures". It was decided to hold the 4th Meeting of the Committee in Torino on that occasion. The principal topic of the Symposium is in fact represented by the scale effects on the tensile properties of disordered materials, which is also a research theme for the ESIS TC9.

Forthcoming Seminar

Seminar to Probe Importance of Ductile Behaviour in Safety-Critical Components

TWI (The Welding Institute) and the Nuclear Safety Division of the Health and Safety Executive have organised Constraint and the Definition of Upper Shelf Behaviour, a one-day seminar on 12 April 1994.
The Seminar will provide a forum for examining the technical issues surrounding the premise that it is vital to ensure that safety-critical ferritic steel components behave in fully ductile manner, i.e. the material is on the upper shelf of its ductile-brittle transition.
Sir Alan Cottrell, internationally recognised authority on nuclear installation safety and a former Chief Scientific Advisor To HM Government, will give the seminar's keynote talk. This will be followed by presentations on research activities sponsored by the Health and Safety Executive through its Nuclear Safety Research programme and the Nuclear Installations Inspectorate.
International research, industrial practice, experience and views will be presented by authoritative speakers from France, the UK, Germany and the USA.
The concepts to be discussed - which are important wherever material degradation and/or low temperature excursions will result in operation in the transition region - are pertinent to the power generation, nuclear installation, petrochemical, oil, gas, offshore and transportation industries.
The seminar will be held at TWI's Abington Hall, Cambridge headquarters and further information is available from Rosemary Cook, TWI, Abington Hall, Abington, Cambridge CB1 6AL. Tel. 0223 891162 (Int +44 223 891162); Fax 0223 892588 (Int +44 223 892588).

ECF10
10th European Conference on Fracture

The Tenth European Conference on Fracture will be held under the motto

STRUCTURAL INTEGRITY
Experiments-Models-Applications
in
BERLIN
Federal Republic of Germany
20-29 September 1994.

The call for papers resulted in the submission of about 260 abstracts. This means that we had to reject many papers since we were aiming at not having too many parallel sessions. Many conversations with participants of international conferences support this view. Thus, in view of the limited number of papers for oral and poster presentation we had to reject papers which met the quality standards for an international conference. We have to confess that this was the hardest part of the preparation work and we hope that the authors understand and share our view.

This is the moment for thanking the members of the Scientific Committee

Prof. W. Brocks	Prof. J.F. Kalthoff	Prof. H. Louis	Prof. A. Saxena
Prof. D. Firrao	Dr. M. Koçak	Dr. I. Milne	Dr. W. Schmitt
Dr. R.K. Gillot	Prof. J. Landes	Prof. Dr. Munz	

for their tremendous efforts in reviewing the abstracts. Since each abstract was reviewed by at least two persons each member had to read at least 40 abstracts.

We will have about 80 oral presentations in 2 to 3 parallel sessions plus 100 - 120 posters. In order to make the poster presentations attractive for the authors and for the visitors we will dedicate specific time slots to the posters and we will ask the participants to chose their favourite poster; this way we will determine the

three best posters of ECF 10

In addition we will have the following keynote papers:

E. Morland et al.	ISO Unified Test Method: The development of a Test Standard
G. Gabetta and R.J.H. Wanhill	Assessment of Residual Life of Components Subjected to Environmentally Assisted Cracking
W. Dietzel and K.H. Schwalbe	Standardisation of Fracture Mechanics Based SCC Testing
H. Riedel	Fracture at High Temperatures-Mechanisms and Lifetime Estimation Methods
J.D. Landes	The Impact of Constraint Effects on Fracture Safe Design
A. Saxena	High Temperature Crack Growth Test Methods
A. Pineau	Modelling Micro-mechanics and Statistical Aspects of Ductile Fracture
R.A. Ainsworth	Flaw Assessment Methods Using Failure Assessment Diagrams
K. Wallin	Relevance of Fracture Mechanical Material Properties for Structural Integrity Assessment
M. Koçak and R. Denys	CTOD and Wide Plate Testing of Welds With Particular Emphasis on Mis-Matched Welded Joints.

We also thank the local Organising Committee for taking care of all the organisational matters.
We hope we will see as many of you as possible in Berlin.

Dr. Christina Berger
Prof. Karl-Heinz Schwalbe

Call for Papers

ICM - 7
Seventh International Conference on Mechanical Behaviour of Materials

Location: The Netherlands Congress Centre, The Hague, The Netherlands
Date: May 28 - June 2, 1995

Organized by
European Structural Integrity Society (ESIS)
Delft University of Technology (DUT)

GENERAL INFORMATION

Previous International Conferences on Mechanical Behaviour of Materials, ICM, were successfully organized in Kyoto (1971), Boston (1975), Cambridge (1980), Stockholm (1983), Beijing (1987) and Kyoto (1991). The 7th ICM will be organized in The Hague (The Netherlands) by the European Structural Integrity Society, ESIS, in co-operation with Delft University of Technology.
The organizers are pleased to invite scientists and engineers who are interested in the mechanical behaviour of materials from all over the world to participate in this major international event.

SCIENTIFIC TOPICS

The Conference intends to cover all aspects of the mechanical behaviour of materials, both from an engineering and a scientific point of view and including a broad scope of material classes, from classical structural metals and concrete to polymers, ceramics, composites, rock, and advanced materials for special applications (e.g. microelectronics, biomaterials). Areas of interest include:

- conditions (during processing, manufacturing, service)
- mechanisms (deformation, damage, surface degradation, low- and high cycle fatigue, creep, instability and fracture, incl. possible interactions)
- loading conditions (high rate, low rate, sustained, cyclic, impact, multi-axial)
- environment (high/low temperature, corrosive and other aggressive environments)
- processing related properties
- modelling techniques
- testing and evaluation techniques
- design for reliability and safety, artificial intelligence
- environmental aspects, recycling

Special emphasis will be given to the following topics:

- micromechanical modelling of deformation and damage/failure processes
- transferability of properties from test specimens to actual structures and components (effect of constraint, multi-axial stress state)
- relations between microstructure and macroscopic properties, structure related properties
- simulation of processing and manufacturing processes
- effects of surface modification and degradation on mechanical behaviour

Some of these topics will be highlighted in 7 or 8 invited plenary lectures, to be presented by experts in these fields. Until now the following persons have agreed to present a plenary lecture (titles are indicative only):

P.E.J. Flewitt (Nuclear Electric plc, UK)
Structural integrity of high-tech components - experience of the end user

J. van Mier (Delft Univ. of Technology, The Netherlands)
Damage analysis of brittle disordered materials: concrete, rock and ceramics

W. Michaeli (RWTH Aachen, D)
Relation between mechanical behaviour of polymers and processing methods and/or conditions

A. Pineau (C. des Matériaux Pierre-Marie Fourt, France)
Micro and macro modelling of mechanical behaviour of materials: the effect of inhomogeneity and anisotropy

R.A. Schapery (Univ. of Texas at Austin, USA)
Time dependent damage development

C.M. Sellars (Univ. of Sheffield, UK)
Mechanical behaviour of metals during thermomechanical processing

V. Tvergaard (University of Denmark, Denmark)
Micromechanisms of the mechanical behaviour of metals

CONFERENCE LOCATION AND DATES

The Conference will be held from Sunday May 28 (registration and reception) to Friday June 2, 1995, in the Netherlands Congress Centre, one of the most modern conference facilities in the Netherlands and located close to both central The Hague and to the sea-side resort Scheveningen.
The Hague, the seat of the Government and the Royal Residence of the Netherlands, is a city of international standing, amongst others through the residency of the International Court of Justice in the Peace Palace.

EXHIBITION

An exhibition of commercially available testing and measuring equipment and other hardware products, as well as software products and services in the area of mechanical behaviour of materials will be organized. Companies which are interested to take part in this exhibition are invited to contact the ICM7 Secretariat for further information.

TECHNICAL VISITS AND SOCIAL PROGRAM

A number of technical visits to places of interest within the scope of ICM-7, as well as a partners program will be organized during the Conference. Details of these will be given later.

PREREGISTRATION

Those who are interested in ICM-7 are kindly invited to contact as soon as possible, but not later than 1st January 1994:

ICM7 Secretariat, c/o Congress Office ASD
Asvest 22, P.O. Box 40
2600 AA Delft, The Netherlands
Tel. (+31)15-120234, Telefax (+31)15-120250

CALL FOR PAPERS

All intending authors are invited to submit abstracts of a maximum of 2 pages before 1st July 1994. The abstract must be printed on white A4 (210 x 297 mm) paper in a 140 x 240 mm frame. Abstracts must contain: title, author(s), full addresses and fax number, introduction, experimental/theoretical/numerical procedures, results, discussion and conclusions. The original abstract, a floppy disk (3.5 or 5.25", file format Word Perfect 5.1 or a lower version is preferred, tables and figures must be camra ready) and five copies of the abstract are requested.

Authors will be informed on the acceptance and the category of accepted presentations (oral, poster) by Fall 1994.

PUBLICATION

Accepted abstracts will be collected in a Book of Abstracts, which will be available at the conference, together with a volume with all invited contributions (most probably in the form of a special issue of a renowned international journal). In addition, all authors of accepted contributions will be invited to submit a full paper before 1st January 1995 for publication in one of the following periodicals:

- International Journal on Fatigue and Fracture of Engineering Materials and Structures (Univ. of Sheffield/ESIS)
- Mechanics of Materials (Elsevier)
- Journal of Materials Processing (Elsevier)
- Materials Science and Engineering A (Elsevier)
- Theoretical and Applied Fracture Mechanics (Elsevier)
- International Journal of Plasticity (Pergamon)
- International Journal of Mechanical Sciences (Pergamon)
- International Journal on the Mechanics and Physics of Solids (Pergamon)

All received full papers will be subject to an acceptance and reviewing process as generally applied for these journals, executed in co-operation between the ICM-7 program committee and the Chief Editors of these journals. All participants will receive copies of a selection of own choice of these special issues, free of charge.

A third circular including forms for formal registration and hotel reservation will be sent to all respondents early 1994.

Deadline

Copy for ESIS Newsletter 25
Summer 1994

The next ESIS Newsletter, nr. 25 (Summer 1994) is scheduled to be mailed by early June 1994. Deadline for copy is:

May 15, 1994

Some Remarks on the

Present State of Failure Criteria

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The ultimate goal of Strength of Materials is to define conditions for a material to fail. For that, accurate knowledge of the mechanical properties of the material and stress/strain fields is a prerequisite. Then, a certain condition connecting material properties and stress/strain fields is "invented" to separate between permissible and non-permissible external loads.

Although it is not intended here to present a historical review of failure criteria we can mention in brief the attempts for their development. They started with Coulomb and through Tresca, Maxwell, Rankine etc. ending with von Mises and belongs to what we, usually, call "Strength of Materials".

When available at the era of von Mises failure criteria seemed inaccurate to explain failures of metallic bridges and vessels, Griffith introduced a great idea by assuming the pre-existence of a crack in the material controlling the failure of structures. This idea was so fertile as to allow the development of a new branch in Strength of Materials called "Fracture Mechanics". Gradually, Fracture Mechanics shifted from the study of a precracked specimen to the study of the crack itself, which is a conceptually different approach. As a result, at least, freshmen at Universities distinguish Strength of Materials from Fracture Mechanics as if they were non-related areas. Fracture Mechanics appears to arrive to an end at our days when scientific societies, like ours, change their names to exclude the word "Fracture" and presumably new approaches like Damage Mechanics seem to be in fashion.

Nevertheless, before their apparent decline both branches had in common that ***a failure criterion could be expressed in words.*** Namely, a physical phenomenon or mechanism was considered as the cause of failure and, afterwards the respective algebraic description of this mechanism was attempted. Coulomb's or Griffith's criteria can be explained to students without a blackboard. Then, students can "invent" suitable algebraic expressions using their previous knowledge on Mechanics or Physics. In other words, failure of materials was considered as a physical phenomenon requiring mathematical description and not a mathematical formulation reflecting a physical reality.

Eventually, both the main branch of Strength of Materials and its variation of Fracture Mechanics arrived to the same inconvenient situation. Plethora of experimental data from various loading conditions and structural geometries along with the development of new materials with, at first glance, peculiar properties formed an explosive situation. Classical criteria seemed not working . Industry and other sponsors triggered the explosion: they asked for results ***now***.

Scientists escaped from this difficult position by giving results which, perhaps were valid only for "now". Actually, they presented results in "compact form" i.e. equations obtained through curve fitting procedures on experimental data. They called these empirical equations "failure conditions" to keep the tradition. An industry of "empirical" failure criteria was established [1]. I reckon that a new fracture criterion appears at almost every issue of Engng. Fracture Mechanics or Int. J. of Fracture, the same being, I am afraid, true for journals specialised to Metal forming or Geomechanics. The range of applicability of these criteria is not carefully described. Sometimes, they only accurately predict the experiments they are based on. Students wonder: "What this criterion implies in physical terms? How can I select the proper criterion for a given application or material? Apparently, I need a criterion for selecting criteria!"

I have no idea how to develop such a super-criterion. It seems easier an attempt to gather experience from existing approaches, to be taught by their doubtful features and to recall from my memory fundamental laws of materials, in order to get a "normal" criterion. Such a criterion must contain at least one "failure parameter" ***independent from geometry***. We must assume that a certain material fails somewhere in its body or as a whole when a mechanical quantity takes a critical value which remains constant for every shape and size of the structural member. This invariant mechanical quantity should be the failure parameter we ask for. Independence from geometry presents the great advantage of reunifying classical Strength of Materials (e.g. Metal forming) and Fracture Mechanics criteria, because cracks are part of the structural geometry and not disturbers of the character of the material. A crack accelerates (makes easier) the satisfaction of the same failure condition, which condition is unique for the material, but does not modify its identity as it is expressed by its failure parameter(s).

Furthermore, the same failure parameter must be independent from the loading system in the sense that it must keep the same value regardless the level of loads, the ratio of normal to shear stresses, plane stress or plane strain conditions etc.

In addition, failure parameter(s) must have an easily recognisable physical content, in order to increase the reliability of the criterion or in other words to allow "conceptual extrapolation" in cases not tested experimentally. Such a conceptual extrapolation is safe only when the phenomenon under study supposingly obeys to a physical law, which by definition is of much wider validity than any empirical equation.

Finally, the criterion, we are asking for, must work. It must explain well defined experimental evidence from various geometries, loading systems and materials to the highest possible quantitative accuracy. If so, it may be suitable to be

applied in new applications with a minimum of experiments or without the necessity of new experiments at all. Having in mind these desirable properties we may recall the standard behaviour of all the materials when they are loaded by any system of external loads. ***Under any possible circumstances any possible material changes its volume and/or its shape.*** A third alternative does not exist. It is reasonable to assume that both changes have an upper limit. Otherwise, materials could store infinite amount of mechanical work. Let us describe these two upper limits in terms of strain energy densities. It is known that external mechanical work is distributed into the material in two components of strain energy, dilatational T_V representing the cost of volume changes and disortional T_D representing the cost of shape changes. In the simplest and most common case of an isotropic, homogeneous material following the Mises yield condition the available (elastic) parts of them are:

$$T_V = \frac{1}{18K} p^2, \quad T_D = \frac{1}{6G} \bar{\sigma}^2 \qquad (1)$$

where p is the hydrostatic pressure, $\bar{\sigma}$ the Mises equivalent stress and K,G the bulk and shear moduli of the material, respectively. If we put limits to these two strain energy densities we conclude that:

A material fails when the maximum value of either the dilatational strain energy density or elastic disortional strain energy density takes a respective critical value $T_{V,0}$ ***or*** $T_{D,0}$.

This statement constitutes the "wording" of the T-criterion of failure [2,3]. It is expressed in words and contains physical meaning. It remains to check whether or not its two failure parameters $T_{V,0}$ and $T_{D,0}$ are geometry-independent and, mainly, if it works. For that we apply it to two classical cases obtained from Fracture Mechanics and Metal forming, respectively.

A) An example from Fracture Mechanics

Almost all fracture criteria are based on the concept of Stress Intensity Factors (SIF). Experiments for the evaluation of this quantity at the moment of crack initiation result in the curve shown in Fig. 1. The reliability of experiments cannot be disputed. Consequently, it is easily concluded that either the SIF is not a material property (in spite of what is written in most of Fracture Mechanics Textbooks) or specimen thickness is a material property! The first alternative obsoletes Fracture Mechanics books and the second violates fundamental principles of Mechanics.

Recently, it was shown [4] that along the curve of critical SIF varying with specimen thickness, there does exist a mechanical quantity keeping a constant value. This quantity is the critical dilatational strain energy density, $T_{V,0}$. In other words, if we compute the value of the SIF when $T_{V,max} = T_{V,0}$ for varying specimen thickness we obtain the curve of Fig. 1. Consequently, $T_{V,0}$ can be, at first place, considered as failure parameter in the sense we use it here.

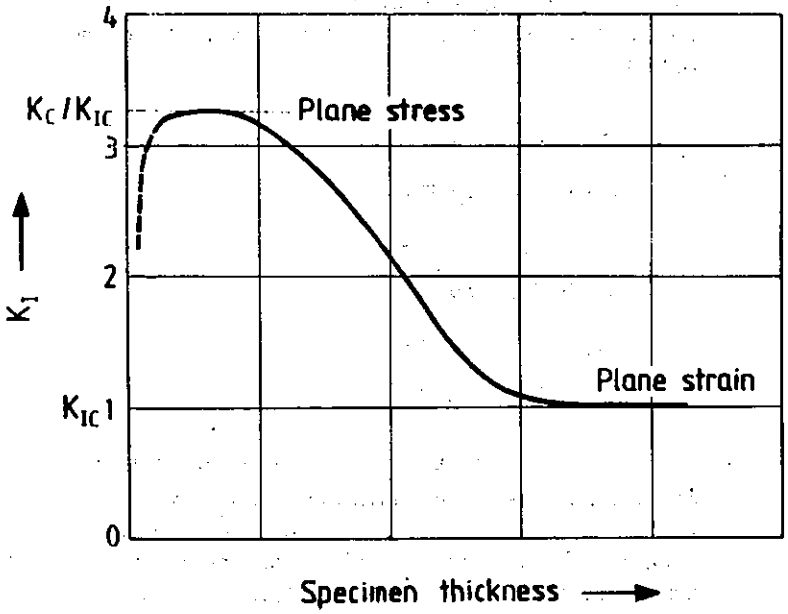

Figure 1
Variation of critical SIF versus specimen thickness

B) An example from Metal forming

Experimental data from metal forming processes are usually presented in Fracture Limits Diagrams (FLD), in terms of two limiting strains as shown in Fig.. 2. The relationship obtained seems to be a straight line with equation [5]:

$$\varepsilon_1 = 1 - 0.5\varepsilon_2 \qquad (2)$$

This result is seriously problematic, not only because experiments do not follow accurately Eq. (2) but mainly because $\varepsilon_2 > 0$ Eq. (2) collapses. Uniaxial stretching into the direction

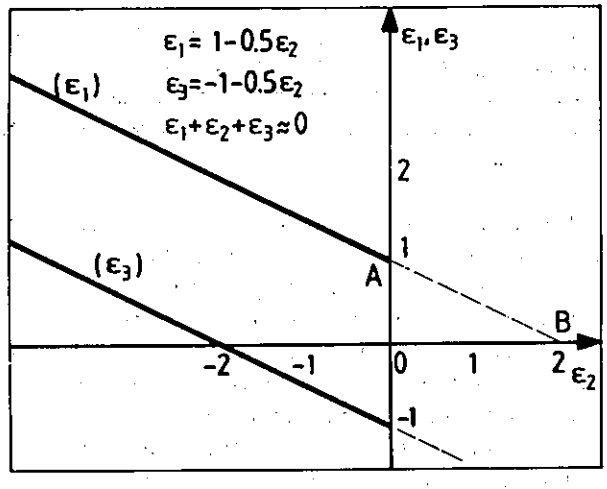

Figure 2
A typical Forming Limit Diagram in the plane $(\varepsilon_1, \varepsilon_2)$

ε_1 terminates at point A when $(\varepsilon_1, \varepsilon_2) = (1,0)$ whereas for uniaxial stretching into the direction ε_2 it terminates at point B when $(\varepsilon_1, \varepsilon_2) = (0,2)$, implying that we can double the strength of a material simply by renaming strains. So, symmetry considerations must be taken into account.
In addition, it is assumed that plane stress conditions prevail in metal forming and, so, the third component ε_3 of strains is ignored. These difficulties drove to the replacement of Eq. (2) by another one of the general form:

$$\int_0^{\bar{\varepsilon}_f} f(\bar{\varepsilon})\,\mathrm{d}\bar{\varepsilon} = c \qquad (3)$$

where $\bar{\varepsilon}$ is the Mises equivalent strain and $f(\bar{\varepsilon})$ is a properly selected function to fit experimental data. But, the main question of what is ε_1 and ε_2 still remains.
To face the problem of nomenclature of strains we may, for simplicity, assume that Eq. (2) is valid and evaluate the third strain through the hypothesis of equivoluminal changes of plastic strains.
Then:

$$\left.\begin{aligned} \varepsilon_1 &= 1 - 0.5\varepsilon_2 \\ \varepsilon_1 + \varepsilon_2 + \varepsilon_3 &= 0 \end{aligned}\right\} \varepsilon_3 = -1 - 0.5\varepsilon_2 \qquad (4)$$

Consequently, in Fig. 2 we can define two limiting lines $\varepsilon_1 = f(\varepsilon_2)$ and $\varepsilon_3 = f(\varepsilon_2)$. By considering symmetry properties of the failure surface of the respective material we can obtain six limiting lines like that of Eqs. (2) and (4) by putting:

$$\begin{aligned} &\varepsilon_A = \varepsilon_1, \quad \varepsilon_B = \varepsilon_2 \\ &\varepsilon_A = \varepsilon_2, \quad \varepsilon_B = \varepsilon_1 \\ &\varepsilon_A = \varepsilon_1, \quad \varepsilon_B = \varepsilon_3 \\ &\varepsilon_A = \varepsilon_3, \quad \varepsilon_B = \varepsilon_1 \\ &\varepsilon_A = \varepsilon_2, \quad \varepsilon_B = \varepsilon_3 \\ &\varepsilon_A = \varepsilon_3, \quad \varepsilon_B = \varepsilon_2 \end{aligned} \qquad (5)$$

where $\varepsilon_A, \varepsilon_B$ are measured along the axes of a symmetric, or complete FLD. The limiting locus we obtain is plotted in Fig. 3. It is a hexagon symmetric to the diagonals of the coordinates system. If we abandon the assumption of linearity of Eq (2) and replace it by a proper second order equation, the hexagon becomes an ellipse. The question related to the present discussion is whether or not a mechanical quantity keeps a constant value along this ellipse. The answer is yes [6]. Elastic distortional strain energy density, T_D, is the required quantity. In other words, we could inscribe the hexagon into an ellipse by simple putting $T_{D,max}=T_{D,0}$ instead of following a lengthy and, perhaps, shaky argumentation. Consequently, $T_{D,0}$ can be, at first place, considered as a second failure parameter in the sense we use it here.

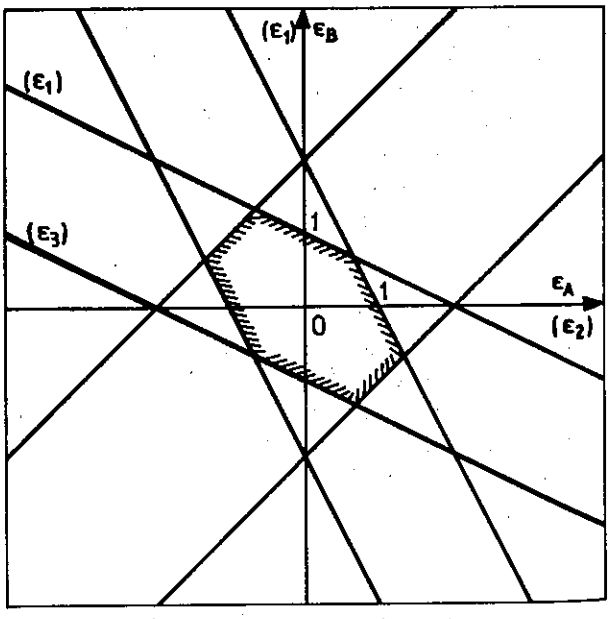

Figure 3
The symmetric or complete plane stress FLD

These two failure parameters ($T_{V,0}$ and $T_{D,0}$) are the only ones required for the description of the failure of materials, at least for those following the Mises flow rule. We could continue with other applications of the T-criterion for example how it works in case of the so-called "stable" crack propagation or how it is related to R-curves etc. We have a lot of open questions waiting for an answer, like anisotropic materials, fibrous composites, fatigue etc. But, since the T-criterion is based on general laws of Mechanics, we have no serious reason to doubt.
For the time being, the most promising application of the

T-criterion is its relationship to the hydrostatic pressure sensitivity of failure loci. Theoretical work and available experimental data show good agreement. For example, the T-criterion predicts the behaviour of mild steels and other conventional metals as they were tested by Bridgman at very high hydrostatic pressures [7]. To my best knowledge no other failure criterion can predict this behaviour. However, the most convincing fact supporting the approach to failure described here is that this is not new. Half of it is the old Mises condition and the remaining is an obvious addition to that condition. In that sense, the T-criterion is considerably aged. Can we conclude that classical approaches are, still, alive and that, perhaps, the we only need to transfer old good wines to new bottles?.

References

[1] Theocaris, P.S., "Variations on the Theme of Fracture Criteria". Engng. Fract. Mech., 33, 205-214, 1989.

[2] Theocaris, P.S. and N.P. Andrianopoulos, "The Mises Elastic-Plastic Boundary as the core Region in Fracture Criteria", Engng. Fract. Mech., 16, 425-432, 1982.

[3] Andrianopoulos, N.P. and P.S. Theocaris, "The Griffith-Orowan Fracture Theory Revisited: The T-criterion", Int. J. Mech. Sci., 27, 793-801, 1985.

[4] Andrianopoulos, N.P. and V.C. Boulougouris, "On an Intrinsic Relationship Between Plane Stress and Plane Strain Critical Stress Intensity Factors", submitted, 1993.

[5] Atkins, A.G. and Y.W. Mai, "Elastic and Plastic Fracture", Ellis Horwood and Wiley, Chichester, 1985.

[6] Andrianopoulos, N.P., "Metal forming Limit Diagrams According to the T-criterion", J. Mat. Processing Technology, 39, 213-226, 1993.

[7] Andrianopoulos, N.P. and V.C. Boulougouris, "Failure by Fracture or Yielding in Strain Hardening Materials According to the T-criterion", Engng. Fract. Mech., accepted, 1993.

ESIS Technical Committee 8

Numerical Methods

Meeting 23rd November 1993 - Freiburg Germany

The meeting was attended by 25 participants from 6 European countries, thus underlining the increasing importance of numerical methods in structural assessment. Three principal contributions and five communications were presented and extensive discussions took place.

1. Evaluation of Constraint and Triaxiality

D. Siegele (Fh-IWM Freiburg) reported on the state of discussion in the sub-committee "Elastic plastic Fracture and Creep" which intends to work out recommendations for the calculation of an appropriate parameter quantifying constraint and its influence on crack initiation and extension. It is well known that J-R curves depend on the specimen geometry, i.e. size and loading type and that this dependence is due to different constraint. A second parameter in addition to J is therefore necessary to transfer crack extension resistance data from specimens to structures. A task group of TC 8.1 with members of GRS (Köln), MPA (Stuttgart), Siemens/KWU (Erlangen) and IWM (Freiburg) has collected data of available numerical analyses to discuss the questions:

1. What definition of constraint factor should be used?
2. Are 2D-analysis of specimens sufficient?
3. Quality of analysis (mesh, type of analysis, crack tip modelling,...)?
4. Which size should the elements have at the crack tip and is it necessary to look at the whole ligament?
5. Must crack growth be included, e.g. with constraint being a function of crack extension?

D. Siegele summarized the following preliminary answers:

ad. 1. The most commonly used definitions are the triaxiality quotient (Clausmeyer), $q = \sigma_e/\sigma_h/\sqrt{3}$, and the inverse definition (Kordisch, Brocks), $h = \sigma_h/\sigma_e$. Both definitions are equivalent, but h has the advantages that
- it increases with increasing constraint
- it is used also in micromechanical material models influencing:
  - the void growth velocity (Rice, Tracey)
  - the yield function (Gurson).

ad. 2. In general, 3D analyses should be used.

ad. 3. see "Recommendations for Use of FEM in Fracture Mechanics", ESIS- Newsletter 15, 1991

ad. 4. Using a material and geometrically nonlinear (UL) formulation, h has a maximum ahead of the crack tip in a distance of about $2J/s_y$, i.e. for structural steels the relevant material zone has the size of (a few) millimetres. Therefore, for calculation of triaxiality data which are relevant for crack extension the element size at the crack tip must be at least in the same order.
The local triaxiality value depends on the coordinates of the integration point and therefore on the mesh size. To overcome this problem (in case of using different mesh sizes for the specimen and the component) a linear extrapolation of h to the crack tip is a helpful method (Schmitt, Brocks).

ad. 5. So far, the considerations are restricted to the stress state at crack initiation.

Supplementary contributions to this topic were presented by

- **A. Eberle** (BAM Berlin) on **"Computation of stresses and related quantities"** showing results of parameter studies with ADINA of a C(T) specimen with varying element formulations and integration orders;
- **R.M. Andrews** (TWI Cambridge) on **"The effect of biaxial loading on cleavage toughness"** applying the concept of T-stresses for in-plane and S-stresses for out-of-plane constraint;
- **W. Brocks** (IWM Freiburg) on **"The second parameter in J-R curves: constraint or triaxiality"** giving an overview and comparison of the different definitions like T, Q and h.

2. Round Robin on Micro-Mechanical Modelling

W. Brocks introduced the specifications for Phase I of the numerical round robin (see ESIS Newsletter 23). So far, 30 people have announced their interest to participate. Yet, not all of them have access to a damage model in their FE code. HKS is working on the Gurson model and will release it in the ABAQUS 5.4 version by the end of 1994. It was suggested to ask them for a possible pre-release. IWM has developed a Gurson routine in ULJ formulation for ADINA, too, but other users cannot profit by it as ADINA R&D provides the ULH formulation (see point 3.) for the user supplied material only, and will not support the ULJ formulation. The participants agreed that as many relevant data as possible should be provided, collected and evaluated in the course of this activity.
A supplementary contribution was presented by **M. Marinçek** (Ljubljana) on **"Dimensionless Ramberg Osgood Curve"** emphasizing the necessity of providing additional information from tensile testing on the stress vs. strain curve beyond uniform elongation.

3. Modelling of Large Plastic Deformations in FE Programs

J. Olschewski (BAM Berlin) gave an extended overview on finite strain plasticity models currently implemented in ABAQUS and ADINA. Starting with a review on the necessary ingredients of a plasticity model, the problems arising with finite strain plasticity theories were discussed. In particular, the different assumptions and formulations used in the FE programs to describe the kinematics of finite elasto-plastic deformations and the elastic response were analysed. The predictive capabilities of the plasticity models were investigated on the basis of the simple shear problem in comparing the FE results with results obtained from the finite strain extension of the classical Prandtl-Reuss theory. It was demonstrated that all models used in this investigation predicted the same shear stress - shear strain behaviour independent of the load increment used. But, it was also shown, that the chosen load increment has an influence on the calculated second-order normal stress. The results based on the ADINA-ULH (Updated Lagrangian Hencky) formulation were shown to be strongly dependent on the chosen load increment.
An announced communication by **B. Abersek** (Maribor) on **"Numerical Model for the Calculation of Service Life on GEA"** could not be presented because of lack of time and will be distributed in a written form to the participants.

Obituary

Terry Ingham O.B.E.

Terry Ingham died on the 18th January 1994. During his career, he concentrated on several aspects of fracture mechanics and became well-known and respected by the national and international fracture community. After graduating in metallurgy in 1965 at the University of Leeds, he joined the United Kingdom Atomic Energy Authority (UKAEA) at Culcheth later transferring to Risley as a research scientist. His work included the development of experimental fracture toughness test methods and their relationship to structural behaviour; irradiation damage in pressure vessel steels; the effect of specimen size on the fracture toughness transition regime in ferritic steels, and acoustic emission. All of these topics resulted in noteworthy contributions to the literature, particularly his contributions to an international study of irradiation damage in steel and to the pressure vessel materials section of the Light Water Reactor Study Group Report, usually known as the Marshall Report.
In the former EGF he was a member of the Working Party on Fracture Mechanics Testing Standards were he contributed substantially to the first test procedure P1-87D.
He will be remembered not only for the quality of his work, but also for his energy and commitment. This enthusiasm even in the later stages of his illness was demonstrated by his attendance at a symposium on Constraint Effects in Fracture in Texas during November 1993, so that he could keep abreast of current development.
In 1985 he joined the Nuclear Installations Inspectorate (NII) as a Principal Inspector where he was involved in the licensing aspects of gas cooled reactors and nuclear fuel processing plant. Although this entailed a departure from experimental work, his interest in fracture mechanics continued at both national and international levels. His work at the NII was recognized by the award of the Order of the British Empire (OBE) in the 1994 New Year's Honours List: an honour of which he was justifiably proud.

Our sympathy is extended to his wife and two daughters.

ESIS TC5 Sub-Committee on Conventional Impact Testing

Notice of Open Seminar

Following from the successful Instrumented Impact Testing meeting at NPL London in 1991, ESIS TC5 Sub-Committee on Conventional Impact Testing is holding a one-day seminar on:

The Physical Understanding and Use of Material Properties determined by Dynamic Testing Standards

The aim of the seminar is to improve the understanding and use of material and fracture data obtained from existing and proposed test methods, including instrumented Charpy V, precracked and dynamic tensile tests. The meeting will start at 10.00 on Thursday 28th April 1994 at the SCK/CEN Research Centre, Mol, Belgium. All members of TC5 committees are invited to attend, along with any other ESIS members or their colleagues with interests in this important field. Speakers are expected to include:

Dr. B.K. Neale	Nuclear Electric	UK
Dr. R. Rintamaa	VTT	Finland
Dr. W. Böhme	Fraunhofer Inst. IWM	Germany
Prof. K. Wallin	VTT	Finland
Prof. J.F. Kalthoff	Ruhr University	Germany
Dr. E. van Walle	SCK/CEN	Belgium

Anyone interested in presenting their work is invited to send title and a short abstract to the organisers by 25th March. Ample time will be allowed for questions and discussion.

There will be no charge for the seminar, but delegates will need to pay for food and for accomodation which is available on-site or at local hotels. For those flying or travelling by train to Belgium, it is planned to provide transport for the one hour journey between Mol and Central Brussels at times to be arranged.

The regular TC5 meeting will be held at the same venue on the following day, Friday 29th April.

For further details please contac t either:

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Imperial College of Science, Technology and Medicine
Exhibition Road
London SW7 2BX, UK
Tel. +44 71 225 8985
Fax +44 71 823 8845

Dr. E. van Walle
SCK/CEN
Department BRI
Boeretang 200
B-2400 MOL, Belgium
Tel. +32 14 332 267
Fax +32 14 321 529

IUTAM Symposium on

Size-Scale Effects in the Failure Mechanisms of Materials and Structures

Politecnico di Torino, Torino, Italy, October 3-7, 1994

The symposium to be held under auspices of the IUTAM, has been organised to bring together researchers with an interest in fracture mechanics, damage mechanics and plasticity. Unifying theme of the symposium will be that of *size-scale effects*, a phenomenon which, in a number of cases, justifies the application of one theory in preference to others. Different scales may be produced by differently sized specimens as well as by different levels of observation, i.e. the micro-, meso- or macrostructural levels. Presentations involving the concepts of disorder, fractality, renormalisation group theory, dimensional analysis, statistical physics, catastrophy theory, etc. are encouraged. IUTAM symposia are designed to bring together researchers who are active within a well-defined field and to achieve effective communication within the group. Presentations are therefore limited to invited speakers, who are given the opportunity to deliver substantial papers on the specific area, with formal and informal discussions from all participants being an integral part of the conference format. Forty invited addresses will be given by leading international figures. At the same time, poster sessions are planned in order to elicit additional contributions to the symposium.

Those interested to present a poster and/or attend the symposium should contact:

Prof. Alberto Carpinteri
Dept. of Structural Engineering
Politecnico di Torino
10129 Torino, Italy
Fax +39 11 5644899

If it is of assistance to prospective delegates, the organisers can issue a formal invitation to participants.

First Announcement and Call for Papers

Fatigue Design 1995

Location: Helsinki, Finland
Date: September 5-8, 1995

Organized by
VTT, Technical Research Centre of Finland
ESIS, European Structural Integrity Society

GENERAL INFORMATION

In May 1992 more than 140 engineers and researchers from 25 countries gathered in Helsinki for the International Symposium on Fatigue Design, FD'92. Presentations and discussions during this gathering focused on topics such as the quantification of service load data, the identification of stress states and failure modes, realistic fatigue life predictions of components, and residual life assessment of damaged engineering structures. Attention was also given to the philosophy of fatigue design together with the need for simple yet reliable fatigue life prediction tools to help ensure the adequate fatigue strength of products at the design stage.

A selection of papers from the FD'92 symposium is now available as ESIS Publication 16: ***Fatigue Design*** (published by MEP).

Participant response during the symposium indicated the desire for a follow-up meeting in 1995. The objective of FD'95 will be to provide useful tools for performing ***fatigue analysis of industrial Components***. Special emphasis will be given to the role of ***component testing*** in the design process as a means both to ensure reliability and to provide feedback for improving analysis techniques and design optimization.

SCOPE

The symposium will focus on ***practical aspects of designing components and structures*** to avoid fatigue failure. Strategies, methods and case studies for ***component testing and analysis*** during the design process will be emphasized. An informal forum will be provided for discussing experiences, recent progress and future research on fatigue life prediction of engineering structures.

Keynote Lecture

The keynote lecture will be given by Dr.-Ing. Walter Schütz, IABG, Germany. His topic is ***"Fatigue Design"*** and will be based on numerous case studies and many decades of practical experience.

CALL FOR PAPERS

Papers on the following topics are sought:

- Case Studies and Fatigue Design Experience;
- Good Design Practice;
- Component Testing;
- Service Loading;
- Residual Life Assessment;
- Multiaxial Fatigue;
- Probabilistic Analysis;
- Design and Analysis of Welds;
- Fatigue Life Improvement.

Prospective authors are kindly invited to submit a title and abstract of 300-500 words together with a complete list of co-authors and contact information by 31 September 1994 to the FD'95 Office. Final manuscripts are due before 31 May, 1995.

ORGANIZATION

Address correspondence to:

Gary Marquis
FD'95 Office
VTT Manufacturing Technology
P.O. Box 1704
FIN-02044 VTT, Finland
Tel. (+358)0-456 6866
Fax (+358)0-456 7002

Wessex Institute of Technology

THIRD INTERNATIONAL CONFERENCE

LOCALIZED DAMAGE 94

Computer Aided Assessment and Control

21 - 23 June 1994
Udine, Italy

Organized by
Wessex Institute of Technology, Southampton, UK
and
International Centre for Mechanical Sciences, Udine, Italy

Sponsored by
ESIS (European Structural Integrity Society)

The first and second International Conference on Computer Aided Assessment and Control of Localized Damage were held at Portsmouth, UK (1990) and Southampton, UK (1992). Following the success of these Meetings, the third Conference is being organized by the Wessex Institute of Technology and International Centre for Mechanical Sciences (CISM).

OBJECTIVES

The purpose of the Conference is to promote further international co-operation amongst Scientists and Engineers from diffferent disciplines involved in the study and assessment of localized damage. The overall objective is to produce an integrated approach to the problem of Fracture, Fatigue and Safe Design with emphasis placed on the application of advanced theories. The Conference will discuss papers on any of the topics listed below, or others related to the theme of the Meeting. The participants are encouraged to critically review existing ideas and to explore new research ideas for a wide range of applications, including **dynamics** and **static loadings, probabilistic** as well as **deterministic** and applications in design.

CONFERENCE TOPICS

Papers are invited on the topics outlined below; abstracts should be forwarded immediately.

- Fracture Mechanics
- Crack Propagation and Control
- Fatigue
- Failure Analysis
- Creep and High Temperature
- Plasticity and Viscoplasticity
- Environmental Effects
- Damage Mechanics
- Microstructural and Micromechanical Modelling
- Composite Materials
- Dynamic Fracture
- Corrosion
- Design Consideration
- Knowledge Base Systems
- Industrial Applications
- Residual Stress
- Finite Elements, Boundary Elements and other advanced Numerical Techniques

If you are interested in attending the Conference and/or receiving further information, please contact the Conference Secretariat:

Jane Evans
CAACOLD94
Wessex Institute of Technology
Ashurst Lodge, Ashurst, Southampton SO4 2AA UK
Tel 44 (0)703 293223 Fax 44 (0)703 292853
EMail CMI@uk.ac.rl.ib Intl EMail CMI@ib.rl.ac.uk

Agenda of Fatigue and Fracture Events

Agenda items are placed free of charge.
Inform the editor about any meeting of interest to the readers of this Newsletter

March 10-12, 1994
XIIth International Colloquium on Mechanical Fatigue of Metals - ICMFM-XII
Location : Miskolc, Hungary
Organizer : University of Miskolc
Sponsors : **ESIS**, EEC DGXII, *et al.*
Deadlines : Dec 31, 1993 - Abstracts (500 words)
Inquiries : Dr. László Tóth
Department of Mechanical Engineering
H-3515 MISKOLC-Egyetemváros
Tel. (+36)46-366-11 ext. 11-97
Fax (+36)46-311-140 or 365-174 or 369-554

March 13-14, 1994
4th International Symposium on Toughened Plastics: Science and Engineering
Location : San Diego, CA, USA
Organizer : Am. Chemical Society - Div. Polymeric Materials
Deadlines : Dec. 31, 1992 - Paper submittal form
Sep. 1, 1993 - Abstract
Oct. 1, 1993 - Manuscript
Inquiries : Prof. A.J. Kinloch
Dept. of Mechanical Engineering
Imperial College
Exhibition Road
London SW7 2BX, UK
Tel. (+44)71-2258982, Fax (+44)71-8238845

March 21-22, 1994
3rd Int. IMEKO Symposium on Laser Metrology for Precision Measurement and Inspection in Industry
Location : Heidelberg, Germany
Organizers : GMA, IMEKO
Deadlines : Sep. 1993 - Abstracts (2 pages)
Jan. 1994 - Full manuscripts
Inquiries : VDI/VDE-Gesellschaft Meß- und Automatisierungstechnik (GMA)
PO Box 101139, 40002 Düsseldorf, Germany

April 11-14, 1994
Deformation, Yield and Fracture of Polymers
Location : Cambridge, UK
Organizer : IOM *et al.*
Deadlines : Sep. 1, 1993 - Synopsis (300w)
Jan. 1, 1994 - Extended abstracts (4 pages)
Inquiries : Mrs. Debbie Schorer
Conference Dept. (C406)
The Institute of Materials
1 Carlton House Terrace, London SW1Y 5DB, UK
Tel. 071-9761339, Fax 071-8393576

April 12, 1994
18. Sitzung der SVMT-Fachgruppe Bruchmechanik and Ermüdung. Themes: Schwing- und Betriebsfestigkeit; Versagen bei komplexen Beanspruchungen (Fatigue and Failure unde Complex Loading)
Location : EMPA Dübendorf bei Zürich (CH)
Language : German and French, others ask Dr. Prodan
Deadlines : March 1, 1994 - announcement of contribution and registration
Inquiries : Dr. Niklaus Prodan
Steig 20
8193 Eglisau (ZH), Switzerland

April 12, 1994
Seminar on Constraint and the Definition of Upper Shelf Behaviour
Location : Cambridge, UK
Organiser : TWI, Cambridge, UK
Remarks : Invited speakers only
see elsewhere in this Newsletter
Inquiries : Mrs. Rosemary Cook
TWI
Abington
Cambridge CB1 6AL, UK
Tel +44 223 891162, Fax +44 223 892588

May 4-6, 1994
International Symposium on Advanced Structural Integrity: Methods for Airframe Durability and Damage Tolerance
Location : Hampton, Virginia, USA
Sponsors : FAA, NASA
Organization : NASA Langley Research Center
Deadlines : Jan 7, 1994 - Extended Abstracts
Apr 15, 1994 - Full Papers
Inquiries and mail address : Arij U. de Koning
Nat. Aerospace Laboratory, NLR
P.O.Box 153,8300 AD EMMELOORD, The Netherlands
Fax (+31)5274-8210

May 10-12, 1994
2nd Int. Conference on Engineering Integrity Assessment
Location : Glasgow, UK
Organizer : Dynamic Testing Agency
Engineering Integrity Society
Deadlines : Feb. 1, 1993 - Abstract (200-300 w.)
March 1, 1993 - Prov. acceptance
Aug. 1, 1993 - Full papers
Nov. 1, 1993 - Notification of acceptance
Jan. 15, 1994 - Final version of papers
Inquiries : Neil Harwood, Dynamic Testing Agency
Structures and Materials Centre - NEL
East Kilbridge, Glasgow G75 0QU, UK
Tel. 03552-72363, Fax 03552-72047

May 16-17, 1994
3rd Symposium on Advances in Fatigue Lifetime Predictive Techniques
Location : Montreal, Quebec, Canada
Sponsors : ASTM Committee E-8
Deadlines : May 17, 1993 - Abstracts (250-300 w.)
Inquiries : M.R. Mitchell
Rockwell Int., Science Center
1049 Camino Dos Rios, Thousand Oaks, CA 91360, USA
Tel 805/373-4450, Fax 805/373-4500

May 18-19, 1994
Symposium on Pendulum Impact Machine: Procedures and Specimens for Verification
Location : Montreal, Quebec, Canada
Sponsors : ASTM Committee E-28
Deadlines : June 18, 1993 - Abstracts (250-300 w.)
Inquiries : Mrs. Dorothy Savini
Symposium Operations, ASTM
1916 Race Street, Philadelphia, PA 19103-1187, USA
Tel 215/299-2617

Agenda cont'd

May 31-June 2, 1994
4th International Conference on Biaxial/Multiaxial Fatigue
Location : Paris, France
Organizers : SF2M, ESIS
Deadlines : Sep. 1, 1993 - Abstracts (300-500 w)
March 1, 1994 - Full papers
Inquiries : Société Française de Métallurgie et de Matériaux (SF2M)
Biaxial/Multiaxial Fatigue
1 rue Paul Cézanne, 75008 Paris, France
Tel. (+33)1-49537237, Fax (+33)1-49537100

May 30 - June 1, 1994
15th Conf. on Materials Testing in Metallurgy/11th Conf. on Materials Testing: EUROMAT 94
Location : Balatonzéplak, Hungary
Organizer : OMBKE, GTE Hungary
Deadlines : July 30, 1993 - Abstracts (200 words)
Jan, 1994 - Full papers
Inquiries : Scientific Society of Mechanical Engng.
Congress Department
PO Box 451, 1372 Budapest 5, Hungary
Tel. (36 1)153-0340, Fax (36 1)153-0818

June 1-3, 1994
3rd Int. Conf. on Structures under Shock and Impact - SUSI 94
Location : Madrid, Spain
Organizer : Wessex Inst. of Technology, UK
Un. Politecnica de Madrid, Spain
Deadlines : Aug 2, 1993 - Abstracts (300 words)
Inquiries : Sue Owen, Wessex Inst. of Technology
Ashurst Lodge, Ashurst, Southampton SO4 2AA, UK
Tel. (44)703 293223, Fax (44)703 292853

June 8-10, 1994
Fourth International Conference on Residual Stresses - ICRS 4
Location : Baltimore, Maryland, USA
Organizer : SEM, Bethel, CT, USA
Deadlines : Jan. 15, 1993 - Abstracts (500 words)
July, 1993 - Notification of acceptance
Nov. 1, 1993 - Final manuscripts
Inquiries : Dr. Michael James, SEM, Inc.
7 School Street, Bethel, CT 06801, USA
Tel. (203)790-6373, Fax (203)790-4472

June 21-23, 1994
3rd Int. Conf. on Localized Damage - Computer Aided Assessment and Control
Location : Udine, Italy
Organizer : Wessex Inst. of Technology, UK
Int. Centre for Mechanical Sciences, Italy
Inquiries : Jane Evens - CAACOLD94, Wessex Inst. of Technology
Ashurst Lodge, Ashurst, Southampton SO4 2AA, UK
Tel. (44)703 293223, Fax (44)703 292853

June 29 - July 1, 1994
4th International Conference on Computer Aided Design in Composite Material Technology - CADCOMP 94
Location : Southampton, UK
Organizer : Wessex Inst. of Technology
Inquiries : Pam Spalding, Wessex Institute of Technology
Ashurst Lodge, Ashurst, Southhampton SO4 2AA, UK
Tel. (+44)703-293223, Fax (+44)703-292853
E-mail CMI@ib.rl.ac.uk

July 11-13, 1994
3rd Int. Conf. on Teaching and Education in Fatigue and Fracture - TEFF-3
Location : Vienna, Austria
Organizer : TU Vienna
Sponsors : **ESIS**, ISTLI
Deadlines : Dec. 31, 1993 - Abstracts (500 words)
Inquiries : Dr. H.P. Rossmanith, Institute of Mechanics, TU Vienna
Wiedner Hauptstraße 8-10/325
1040 Vienna, Austria
Tel. (0-222) 58801-5514, Fax (0-222)587 58 63

July 18-22, 1994
10th International Conference on Experimental Mechanics
Location : Lisbon, Portugal
Organiser : Potuguese Society for
Experimental Stress Analysis
Deadlines : July 31, 1993 - Abstracts
Dec. 31, 1993 - Final papers
Inquiries : Secr. 10th Int. Conf. on Exp. Mech
APAET, Laboratório Nacional de Engenharia Civil
Av. do Brasil, 101, 1799 Lisboa Codex, Portugal

September 5-9, 1994
15th Risø Int. Symposium on Materials Science: Numerical Predictions of Deformation Processes and the Behaviour of Real Materials
Location : Roskilde, Denmark
Organiser : Risø National Lab., Roskilde, DK
Deadline : Jan 15, 1994 - Abstracts
Inquiries : Secretariat 15th Risø Int. Symposium
Materials Department
Risø National Laboratory
P.O. Box 49
DK-4000 Roskilde, Denmark
Tel. +45 46 77 5703 Fax +45 42 35 1173

September 20-23, 1994
10th European Conference on Fracture - ECF10
Location : Berlin, Germany
Organiser : DVM
Sponsor : **ESIS**
Deadlines : June 30, 1993 - Abstracts
Jan. 15, 1994 - Full papers
Inquiries : Mrs. I. Maslinski, DVM
Unter den Eichen 87, 1000 Berlin 45, Germany
Tel. (30)8113066, Fax (30)8119359

September 26-28
EUROMECH 326 Colloquium "Experiment and Macroscopic Theory in Crack Propagation" (fast crack growth)
Location : Kielce, Poland
Organisers : Kielce University of Technology
Ruhr University
Inquiries : Prof. A. Neimitz
Kielce University of Technology
Al. Tysiaclecia P.P. 7
25-314 Kielce, Poland
Tel. 48-41 416 85, Fax 48 41 429 97
E-mail: rek@srv1.tu.kielce.pl

October 3-7, 1994
IUTAM Symposium on Size-Scale Effects in the Failure Mechanisms of Materials and Structures
Location : Torino, Italy
Organizer : Politecnico di Torino
Program : Invited speakers only (40)
Poster sessions for additional contributions
Inquiries : Prof. A. Carpinteri
Dept. of Structural Engineering, Politecnico di Torino
10129 Torino, Italy
Fax (39)11-5644899

October 18-20, 1994
3rd Int. Conference on Ceramic-Ceramic Composites
Location : Mons, Belgium
Organizer : Belgian Ceramic Society
Deadlines : April 1, 1994 - half page abstracts
May 1, 1994 - Notice of acceptance
Jul 15, 1994 - extended abstracts (3 pages)
Oct 18, 1994 - full papers
Inquiries : Dr. F. Cambier, Belgian Ceramic Society
Av. Gouverneur Cornez, 4, B-7000 Mons, Belgium
Tel. (+32)65 348000, Fax (+32)65 348005

Agenda cont'd

May 18, 1995
Symposium on Mechanical Testing of Foils
Location : Denver, Colorado, USA
Sponsors : ASTM Committee E-28
Deadlines : Jan 18, 1994 - Abstracts (250-300 w.)
Inquiries : Mrs. Dorothy Savini
Symposium Operations, ASTM
1916 Race Street, Philadelphia, PA 19103-1187, USA
Tel 215/299-2617

May 28-June 2, 1995
7th International Conference on Mechanical Behaviour of Materials - ICM7
Location : The Hague, The Netherlands
Sponsors : Int. Congress on Mech. Behaviour of Materials
Organizer : ESIS/Delft University
Deadlines : jul 1, 1994 - Abstracts (2 pages)
Inquiries : ICM7 Secretariat
c/o Congress Office ASD
PO Box 40
2600 AA Delft, The Netherlands
Tel (31)15-120234, Fax (31)15-120250

July 18-20, 1995
6th International Symposium om Fracture Mechanics of Ceramics
Location : Karlsruhe, Germany
Organizer : Kernforschungszentrum Karlsruhe
Deadline : Sep 30, 1994 - Abstracts (500 words)
Jun 30, 1995 - Full papers
Inquiries : Mrs. L. Borchardt
Kernforschungszentrum Karlsruhe GmbH
Institut für Materialforschung II
Postfach 3640
D-76021 Karlsruhe, Germany

September 5-8, 1995
Fatigue Design 1995
Location : Helsinki, Finland
Sponsors : ESIS, VTT Manufacturing Technology
Deadlines : Sep 31, 1994 - Abstracts (300-500 w)
May 31, 1995 - Full Manuscripts
Inquiries : Gary Marquis
FD'95 Office, VTT Manufacturing Technology
P.O. Box 1704
FIN-02044 VTT, Finland
Tel.(+358)0-456 6866 Fax (+358)0-456 7002

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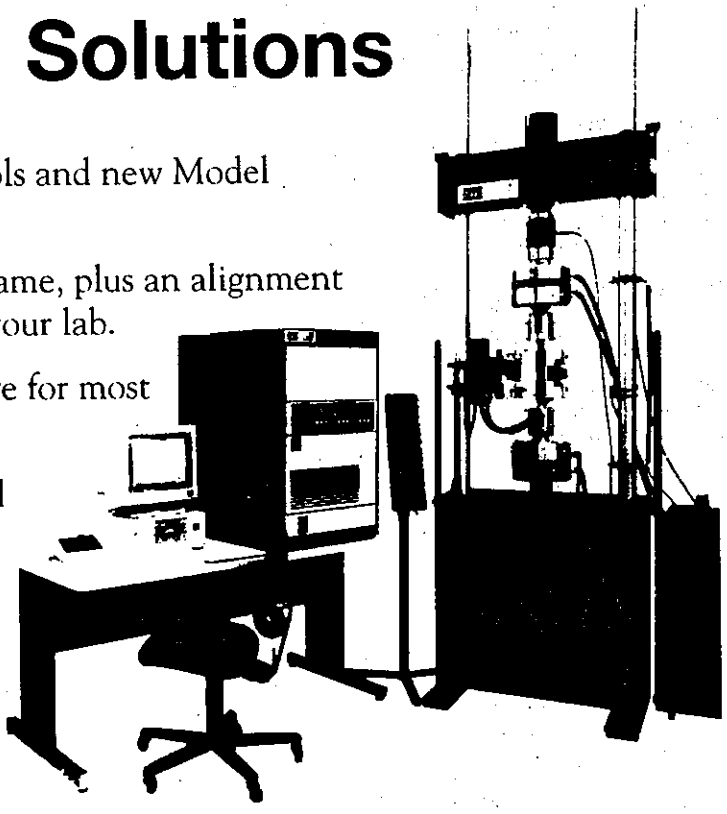

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Amsler Otto Wolpert-Werke GMBH (FRG)

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INASMET – Centro Tecnologico de Materiales (E)

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VTT - Technical Research Centre of Finland (SF)

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R6-CODE

R6-CODE has been developed to assist in the assessment of structures containing defects following the R6 or PD6493 procedures.

R6-CODE addresses all the options and categories of analysis found in the R6 procedure, together with the full range of failure assessment diagrams.

R6-CODE may be run on PC's and Workstations.

R6-CODE can be used with over 140 geometries and plastic collapse solutions.

R6-CODE includes fatigue crack growth.

R6-CODE is fully interactive and includes full graphic assistance together with output on the chosen Failure Assessment Diagram.

For further details of R6-CODE or the R6 procedure please contact Graham Marshall,
Tel +44 453-812341 or Fax +44 453-812009.

Berkeley Technology Centre is at the heart of the technical and scientific development of Engineering Software and Methods within Nuclear Electric.

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✔ *the appropriate box(es):*

☐ Please send me the ESIS Newsletter free of charge (note that this is only required if you did not subscribe before, if your address has been changed, or if the address on the address label is in error)

☐ Please register me as personal ESIS member. The 1993 membership fee is be payed by *(please ✔)*:

○ the enclosed Eurocheque of Dfl 60,-- *(please do not forget your card number at the back-side)*

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my card number is 5 ☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ Exp. Date ☐☐ ☐☐

○ transfer of Dfl. 75,-- to the ESIS bank account 10.42.10.753 at the RABO Bank, Barendrecht, NL , or by cheque payable to ESIS (Dfl. 15,-- is added to cover bank charges)

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Address:

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ESIS Office, attn. Prof. A. Bakker
P.O Box 5025
2600 GA Delft, The Netherlands

Organizations that wish to register 5 or more persons as ESIS personal member (20% reduction), or wish to receive information about ESIS Organizational membership should write to ESIS Office at the address alongside.