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EDITORIAL

Congratulations to Professor Ken Walters FRS on receiving the third Weissenberg award from the European Society of Rheology. For those who weren't in Erlangen, I have reprinted the laudation given by Professor Marcel Crochet.

Other highlights in this issue include an article by Gerry Meeten on how to build a squeeze film rheometer, and another by Zvi Rigbi on regression to exponential functions.

Oliver Harlen

SUBMISSIONS TO THE BULLETIN

Submissions to the Bulletin may be made by any practical means – post, email, disk, fax, pigeon, donkey, et cetera but electronically is preferred (saves typing...). Most packages supported (Word, TeX, LaTeX, WordPerfect, ASCII, RTF) but always provide a contact name, address, eMail, or telephone number in case of problems.

The copy dates for the next three Bulletins are 15 January, 15 June, and 15 October. This should allow me to publish in February, July, and November and, as always, all contributions are gratefully received. Late copy can sometimes be accommodated, however the facilities of the BSR and ESR web sites may also be appropriate. Please contact the Editor for details.

COVER ILLUSTRATION

The cover photograph shows the rheological forming process of a titanium alloy disk at different times: (a) before forming; (b) during forming; (c) after forming. During the forming process of metal blanks in a mould cavity, the questions to be answered are: (1) has the metal filled the whole mould cavity; (2) is it folded or cracked. (3) what influence does the metal's rheology have; (4) can we modify and optimize the relevant parameters step by step. The finite element simulation tries to answer these questions. Taken from the paper "FE Numerical Simulation on the Isothermal Rheological Forming of TC11 Titanium Alloy Compressor Disk", by Li Suyang et al. (Xiangtan University, Hunan, 411105 China), and published as

Proceedings of the XIIIth ICR, Cambridge, UK (2000) 3-368 to 3-370

We are continually looking for colour or black & white pictures (preferably of a rheological nature!) for the front cover of the Bulletin and Rheology Abstracts. Please contact Oliver Harlen (Bulletin Editor), Gary Tucker (Abstracts Editor) or Nick Hudson (Publications Manager). Suggestions are always welcome!

NEW SCOTT BLAIR SCHOLAR – STEPHEN CORBY

Stephen Edward Cordy has become the latest recipient of the Scott Blair Scholarship. Stephen holds a 1st class honours BEng degree in Biochemical engineering from the University of Wales, Swansea. He is currently studying for a Ph.D. in the Department of Biochemical Engineering on a project on the design and construction of a filament stretching rheometer



Scott Blair Scholar, Stephen Cordy, in the Scott Blair Library at Aberystwyth, being congratulated by Professor Ken Walters.

PROFESSOR KEN WALTERS RECEIVES WEISSENBERG AWARD

At the recent European Conference on Rheology at Erlangen, Germany, Professor Ken Walters F.R.S. from the University of Wales at Aberystwyth was presented with the 2002 Weissenberg award. The Weissenberg Award is bestowed biannually by the European Society of Rheology for outstanding, long term achievements in the field of Rheology. It is open to rheologists whose centre of scientific activities lies in Europe. Professor Ken Walters is third ever recipient and the first from the UK.

The address for the presentation was given by Professor Marcel Crochet and is reprinted here with kind permission.

The address to Professor Ken Walters, F.R.S.

European Society of Rheology
Erlangen, September 2, 2002

Professor Marcel Crochet

Mr Chairman, Ladies and Gentlemen, Dear Ken and Mary,

There was a time when, not too many years ago, the preparation of the present address would have required a visit to the library and the tedious consultation of books, journals, citation indexes or international biographies. Today, information technologies have totally upset our working habits; it suffices to open one's computer and to access a search engine such as Google in order to obtain, within seconds, an extraordinary amount of information on the topic of one's choice.

I have tried 'Ken Walters'; the result was astonishing ! 59600 entries!

" Ken Walters becomes president of HiddenMind ",

" Ken Walters artist and illustrator ",

" Ken Walters, a base-ball reference ",

" The legend of Ken Walters ",

" Poetry by Ken Walters ".

Although I am very much aware of Ken's talents, I could not really recognize our colleague. However, some further entries attracted my closer attention :

“Ken Walters can teach just about anyone to ski ”, (which would certainly remind a number of rheologists of exciting meetings and seminars in the French Alps),

“What really sank the Titanic? Why don’t you ask Ken Walters?”,
(Ken, did you discover a new effect ?), or, even better,

“Hard science solves the mystery of a soft drink”.

I could not resist the urge to open the corresponding web-site where I discovered the story of a research student in the Department of Mathematics at the University of Wales, Aberystwyth, who was working on an extraordinary project: to solve the mystery of the world’s most visually stunning soft drink. His supervisor, Professor Ken Walters, on a visit to New-York, had come across an amazing drink called Orbitz: brightly coloured beads of gel are perfectly suspended in the surrounding transparent liquid. It appears solid, yet when poured it has the consistency of water. *A votre santé!* “Just why these gel-like particles remain suspended apparently indefinitely seemed a fascinating question ”, said Ken Walters. Upon returning to Wales, Ken ordered several cases of Orbitz from the manufacturer and gave a most interesting assignment to his student which, I quote the latter, “meant using lots of mathematics and learning how to use a variety of instruments and techniques which was an ideal way to learn”.

The rest of the story belongs to Ken, who would certainly tell you more about the behaviour of Orbitz fluids. It is an illuminating story because, within a few lines, it tells us about what I would call the invariants of Ken’s career: a fascination with physical phenomena; a real urge to understand their origin; mathematical rigor and the use of the most efficient tools, whether analytical or computational; a continuous presence in the laboratory which led to a renowned expertise in rheometry and, last but not least, a strong leadership and inspiration to students and colleagues.

Forty-five years ago, Professor Ken Walters received his own inspiration from Professor Jim Oldroyd who introduced him to the exploration of the almost virgin field of elasto-viscous fluid mechanics, at a time when Navier-Stokes equations were for many academics the sole approach to the description of viscous behaviour. At the outset, Ken devoted his analytical skills to the solution of flows in cylindrical, spherical or parallel plate geometries, not because of their apparent simplicity; rather, an appropriate combination of constitutive models, of mathematical analysis and of laboratory experiments would allow him to understand what really

happens in a rheometer. At a very early stage, he engaged into the use of computational methods to go beyond the capabilities of analytical work; many of his former students are still pursuing his pioneering work in computational non-Newtonian fluid mechanics. A careful inspection of Ken's list of publications reveals how much he is concerned with rigor and with the confusion between reality and appearance in experiments; what else should we expect when a mathematician is willing to enter the laboratory? His world-recognized expertise has led, for example, to new designs in rheometry, to the use of complex test-fluids and to industrial applications related to pipe-flow, lubrication and suspension rheology.

I wouldn't comment more on Ken's outstanding scientific contributions which were duly recognized when he received the Gold Medal of the British Society of Rheology in 1984, when he was elected to a Fellowship of the Royal Society in 1991 and as Foreign Associate of the National Academy of Engineering of the United States in 1995. I would rather elaborate on the action of an inspired leader in our field of rheology; in saying so, I am not only revealing my own feelings but also those of several friends whom I consulted over the last few weeks. Beyond his numerous publications in scientific journals, Ken's leadership unfolded over the years in four major areas.

First, he is one of those rare scientists of our period who understood the importance of writing books at a time when the publication of articles was exploding. His early book on "Rheometry" quickly became a classic for rheologists, with a mine of information at hand. The second, "Numerical Simulation of non-Newtonian Flow", which I co-authored with Russell Davies, was his own idea; it was an exhilarating as much as stressing experience to cooperate for two years on such a project, when new questions would constantly emerge as we were drafting chapters. "An Introduction to Rheology", co-authored with Howard Barnes and James Hutton, is available as well in Chinese and Korean; it is a must in industrial laboratories. "Rheological Phenomena in Focus", co-authored with David Boger, is certainly one of the most provocative books on rheology, collecting within 150 pages a summary of what we observe and hope to understand; it is, I think, a work programme for the next fifty years. *La cerise sur le gâteau*, the cherry on the cake, as we say in French, was "Rheology: An Historical Perspective", co-authored with Roger Tanner.

One might deduce that Professor Walters was not fond of scientific journals. Quite to the contrary! In 1976, Ken created the new Journal of

Non-Newtonian Fluid Mechanics which he has been editing for 25 years, from volume 1 up to 100! JNNFM, as it is nick-named, has quickly become a standard in our field, with its own style and preferred topics, mixing, with perfect alchemy, traditional fluid mechanics, computational mechanics and the specifics of rheology. The Journal is highly cited and avidly regarded by newcomers in the field.

The third area which I wish to mention is most appropriate for the present meeting of the European Society of Rheology. Over the last 25 years, we have witnessed the construction of a new European nation, in search of its identity. Europe has been too often solely associated with its economic development although its cultural and scientific heritage is considerable.

Scientists have been early involved with European progress, through the creation of international programmes between university and industry centres, and the development of academic networks. Ken's participation to the emerging role of European science is considerable.

Finally, should I remind you that Professor Walters is an exceptional teacher who, for the last forty-five years, has



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captivated on all continents audiences of all ages with introductions to or advances in rheology?

I was mentioning earlier about a web-site entitled “The legend of Ken Walters”. Shouldn’t we rather elaborate on “The secret of Ken Walters”? How did he acquire such an endless energy to achieve with great success so many undertakings, while showing at the same time so little strain and so much hospitality?

Many of my friends in this room keep as much as I do fond memories of their visits to Aberystwyth. These were indeed memorable visits where exciting group discussions would alternate with seminars, hard work, delightful lunches prepared by Mary and dinners in the latest gourmet restaurant. Ken and Mary are delightful hosts. I can’t resist reading you a poem written by Professor Bob Bird for the present occasion that summarizes in verses what I am trying to say.

Best wishes to Mary and Ken,
In Wisconsin we’re wondering when
You’ll brighten our day
By coming our way
For canoeing and swimming again.
And also we hope, Ken and Mary,
You’ll return to the “land of the dairy”
And talk about druids
And mischievous fluids
With Bird, Lodge, Schrag, Johnson, and Ferry.

Ken, you will love to hear that one of your achievements, in Bob’s message, is that you have kept alive the memory of Jim Oldroyd.

Friendship, hospitality, frontier-breaking contribution, charismatic leadership, loyalty, care for young rheologists... are typical words quoted by your friends. I wouldn’t resist however to mention other quotations such as ski rheology, gourmet rheology, wine tasting and an unanimous admiration for dessert expertise. David Boger remembers in particular a dinner in Brussels where he believes that you ate six desserts!

Mr Chairman,

- Whereas Professor Ken Walters has devoted 45 years of intense research to the benefit of rheology,
- Whereas he has written five books which have stimulated research in rheology for many decades,
- Whereas he has reinforced the identity of non-Newtonian fluid mechanics through the creation and the editorship of a journal of upper quality,
- Whereas he has, through his academic work, contributed to the reinforcement of European science,
- Whereas scientific as well as industrial centres have largely benefited from his teaching and research,

His colleagues, members of the European Society of Rheology, ask you to bestow on Professor Ken Walters the Weissenberg Award for lifetime contributions to rheology.

THE SQUEEZE-FLOW RHEOMETER

HOW TO MAKE ONE

Gerry Meeten

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Introduction

In squeeze-flow (SF) rheometry a fluid or soft solid sample is squeezed, usually between two rigid parallel circular plates. Over the past 70 years this geometry has been used to investigate many different materials. For viscous fluids and soft solids it offers some real advantages over conventional rheometer geometries, such as coaxial cylinders. I describe here an easily-made SF apparatus that others may find of use, and some basic SF concepts and relations. The rheological literature abounds in SF articles for those who want further study.

The original SF instrument was probably the parallel-plate plastimeter (or plastometer), used to assess the consistency or workability of soft materials in the flourishing plastics and rubber industries of the early 20th century. Today, SF persists in a variety of measurement applications, e.g. the softening and flow characteristics of cheese (Muthukumarappan et al. 1999), or the viscoelastic properties of polymers at low frequencies (Cua and Shaw 2002). Sherwood et al. (1991) used SF as a rheometer for non-uniform filter cakes.

About 70 years ago Scott (1931) described the ‘Theory and Application of the Parallel-Plate Plastimeter’. Unsatisfied by the use of the plastimeter at The British Rubber Manufacturers Research Association, he wrote, “...the empirical methods in general use are probably quite sufficient, but the figures obtained do not represent the fundamental plastic constants of the material...it would be a great advantage to be able to deduce these constants from the readings obtained with the plastimeter...”. He then developed a theory of squeeze flow for non-Newtonian materials, including those with a yield stress. Thirty-five years later at the Bank of England Printing Works Steggles (1966) described a ‘Modified Parallel Plate Plastometer for Testing Intractable Fluids’; sticky printing inks. Steggles noted a valuable advantage of SF, and wrote “The sample cannot form cavities or fissures, so it remains in contact with the entire measuring surface. Being trapped, the fluid is also unlikely to lose volatile

components in the course of its measurement". Covey and Stanmore (1981) advanced the theory of SF, showed that the parallel-plate plastometer was able to measure difficult or stiff materials, and noted that the squeezing pressure applied to the sample discouraged wall slip or brittle fracture.

Although some workers have used spherical surfaces in SF rheometry (Adams et al. 1994, Meeten 2001, Cua and Shaw 2002), we shall consider only parallel circular plates of separation h . Some SF options then are: **(a)** a steady squeeze rate $V = -\dot{h}$, giving a time-dependent force $F(t)$; **(b)** a constant sample volume with increasing sample radius as h decreases; **(c)** a steady squeezing force F giving a time-dependent plate separation $h(t)$; **(d)** a constant sample radius, defined by the plates. The apparatus described here uses the simpler options **(c)** and **(d)**. Today's clever instrumentation could give other interesting options such as $V \propto h$.

SF compared with conventional rheometry

An ideal rheometer gives uniform stress and strain fields over the sample volume. Coaxial cylinders or cone-plate rheometers approximate to this, and so allow the dependence $\tau(\dot{\gamma})$ of shear stress τ on shear rate $\dot{\gamma}$ to be measured. However, τ and $\dot{\gamma}$ vary throughout a sample in SF, making data interpretation less straightforward. Thus Scott (1931) noted, "... it does not seem possible in general to deduce the fundamental stress-flow relationship of the material directly from the relationship between the time of compression and the thickness of the disc".

In SF the sample fluid generally experiences a combination of shear and extensional strain. Even if perfect slip occurs between the sample and the plates, the extensional component means that a SF rheometer still gives some information. For perfect slip, a coaxial cylinders or a cone-plate rheometer is unable to shear the fluid sample and so will give no readings. However, the existence of mixed strains in SF complicates the rheometrical interpretation. Having described some problems of SF, we now describe some advantages.

Squeeze flow is a particularly suitable technique for very viscous liquids or soft solids. The latter are often stiff and sticky fluids of high viscosity and yield stress, difficult to coax into the annular space of a coaxial cylinders rheometer. Many such materials found in food shops and pharmacies are

spread, chewed, or squeezed, and SF is a good way to study them. Similarly, the SF principle is often used for dampers using electro- or magneto-rheological fluids (El Wahed et al. 1999).

An advantage of SF is the small sample volume of typically a few ml; also the thin interplate gap makes for good temperature control. Finally, we note that the SF rheometer also can measure swelling and compression.

Theory

We give a brief description of the literature that describes SF relations for a Herschel-Bulkley fluid squeezed by two flat plates of radius R . The rheology of this fluid is described by

$$\tau = \tau_0 + k\dot{\gamma}^n \quad (1)$$

where τ_0 is the yield stress, k is the consistency, and n is an index. A Newtonian fluid of viscosity η has $n = 1$, $\tau_0 = 0$, and $k = \eta$; a plastic solid has $k = 0$; and a power-law fluid has $\tau_0 = 0$. We neglect the effect of sample elasticity (Meeten 2002).

Slip boundary

Perfect slip occurs in the absence of friction between the sampled material and the plates. It may result from a lubricating liquid between the sample and the plates; some materials exude such a liquid or it may be added. If the plates approach each other in the z -direction with speed $V = -\dot{h}$, a squeezed material will have radial and z -components of flow velocity. If $R \gg h$ the dominant flow is radial and equibiaxial with velocity $u_r = rV/2h$ at radius r , giving a radial extension rate $\dot{\epsilon}_r = V/2h$. The normal stress difference $\sigma_{rr} - \sigma_{zz} = F/\pi R^2$, and a Newtonian fluid of shear viscosity η has a biaxial extensional viscosity $\eta_{EB} = (\sigma_{rr} - \sigma_{zz})/\dot{\epsilon}_r = 6\eta$ (Barnes et al. 1989).

Perfect slip at the sample-plate boundaries of a Herschel-Buckley fluid of (1) squeezed by two flat plates was described by Yang (1998) and Ak and Gunasekaran (2000), giving

$$F = \sqrt{3} p R^2 \tau_0 + 3^{(n+1)/2} p R^2 k (V/h)^n. \quad (2)$$

In the constant- V mode h decreases linearly with time and (2) shows that F will increase with time. The parameters of the H-B relation (1) may be obtained from the variation of F with V/h . In the constant- F mode (if $F > \sqrt{3} p R^2 \tau_0$) then V/h is constant, this being a good test for perfect slip.

No-slip boundary

If $h \ll R$ the predominant flow and pressure gradient are radial, and the radial velocity is a maximum halfway between the plates at $z = 0$. For a Newtonian fluid, one has (Bird et al. 1987)

$$u_r = 3Vr \left(1 - 4z^2/h^2\right) / 4h. \quad (3)$$

The velocity gradient of u_r in the z direction is $\dot{\gamma}_{rz} = 6Vrz/h^3$, i.e. it is zero halfway between the plates, and (at a given radius) largest at the plates ($z = \pm h/2$). The r -dependence of u_r shows that there is also a gradient of u_r in the r direction. Thus an equibiaxial extensional flow coexists with a shear flow. However, if $R \gg h$, the contribution to F from the shear flow is dominant. For the Herschel-Bulkley relation (1), the approach of Adams et al. (1994) gives (Meeten 2002)

$$F = \frac{2\pi R^3 \tau_0}{3h} + \frac{2\pi k R^{n+3}}{(n+3)} \frac{2n+1}{n} \frac{V^n}{h^{2n+1}}. \quad (4)$$

Covey and Stanmore (1981) obtained similar expressions. In the constant- V mode, F will increase with time. In the constant- F mode (if $F > 2\pi R^3 \tau_0 / 3h_1$ where h_1 is the initial interplate separation) then (4) shows that both V and h will decrease with time. When $V = 0$, h will reach a limiting height h_L given by

$$F = \frac{2\pi R^3 \tau_0}{3h_L}. \quad (5)$$

Experimental $V(h)$ data measured in the constant- F mode may be analysed using (4) to give τ_0 , k , and n . Direct measurements of h_L will also give τ_0 via (5) (Meeten 2000, 2001).

Partial-slip

Partial slip at the surfaces of the plates may be particularly apparent in SF if the interplate separation is small (Meeten 2000, 2001). In conventional rheometry there is also much evidence for it (Barnes 1995). Slip in SF has

surfaces may offer more friction for samples prone to slip. Materials other than glass may be used.

The simplest versions apparatus used a purely mechanical gauge. Mitutoyo types 2119F and 2124F measure to 1 mm and 5 mm, respectively. An observer OBS with stopwatch can measure $h(t)$ for a slow-enough squeeze rate, but the Mitutoyo 543-251B digital gauge DG gave much easier data-collection of $h(t)$, which it measured to ± 1 mm and read directly into a PC spreadsheet. The digital gauge DG output socket PT fed a Mitutoyo digital keyboard interface (264 005) DK, connected to the keyboard input socket of a PC. To collect $h(t)$ data, the DK button was pressed periodically by an RS linear solenoid (250-1280) actuated by a low-frequency oscillator. This inserted the gauge reading at that time into a spreadsheet such as Excel (Microsoft), or Kaleidagraph (Synergy Software).

The Mitutoyo dial-gauge stand 7003 was fitted with various Mitutoyo and other components. The stand consists of a base and pillar, and serrated anvil AN. The pillar held a dial gauge DG by means of a Mitutoyo clamp 990 264, comprising parts PC and GC. The pillar clamp PC and the gauge clamp GC are connected via two leaf springs LS, and GC may be raised or lowered by about 1 mm using a handwheel (not shown). The dial gauge allowed motion and force to be transmitted through it via a plunger denoted by UP and LP, each end having a 2.5 mm threaded hole. A Mitutoyo threaded foot FT (101 117) screwed into the upper part UP, secured a washer WA of thickness 1 mm and diameter 15 mm, and supported the weight WT held in a light pan, fixed to the foot by epoxy resin.

A threaded extension rod at the lower end of the gauge connected the lower part of the plunger LP to another foot FT, fixed rigidly to the glass top plate TP using a cone EP of epoxy resin. A 20 or 30 mm rod is made by Mitutoyo; 303 612 and 303 613, respectively. Alternatively, RS Components supply a 25 mm rod (733-716). The bottom glass plate BP rests on the anvil AN. The various dial gauges had internal tension-springs that were extracted carefully by tweezers, after removing the gauge backplate. The total force F acting on the squeezed sample was then due to the added weight WT, and the weight of the plunger, top plate, epoxy, and extension rod.

The washer WA, catch CA and rotary solenoid ROS (RS 440-004) allowed squeezing to begin at a pre-set plate gap. The solenoid was supported by a second PC/GC clamp (not shown) attached to the pillar of the dial-gauge stand. The rotary catch CA (see Figure) was cylindrical over half its length, and a hemi-cylinder over the remainder, shown in the Figure as clear and hatched, respectively. Current from a small 12 V battery, controlled by a user-operated switch SA, rotated the solenoid by 95 degrees. Starting from the orientation in the Figure (where the washer is shown caught by the edge of the hemi-cylinder) the solenoid on actuation rotated the catch by 95 degrees, freed the washer, and allowed the gauge plunger to fall.

Experimental results from the above SF rheometer are described in recent publications (Meeten 2000, 2001, 2002). A SF rheometer with improved data-collection and analysis, developed in the Department of Earth Sciences (University of Cambridge), is to be described (Griffin et al. 2004).

I am grateful to colleagues in Schlumberger and elsewhere for their interest in squeeze flow.

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GH Meeten, September 2002.

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SEMI ANALYTIC REGRESSION OF ASYMPTOTIC FUNCTIONS USING MATLAB[®]

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Many physical phenomena behave asymptotically reaching final stable properties in a short or much longer period. An example of the former is the discharge of a capacitor through a coil. Amongst the latter, we may find the equilibrium between two competing biological systems, relaxation or creep in rheological bodies etc. In such cases it is often possible to shorten experiments by extrapolating the data to long times by fitting to a mathematical formula such as exponential decay.

I have not been able to locate fully analytical methods to carry out regressions on these functions, but semi-analytical methods when supported by suitable software can give fairly good results quite rapidly. These allow the determination of asymptotic values from a small number of early observations.

An example is the study of relaxation of rubber vulcanizates used as seals in various engineering situations. Such tests take a long time to reach their final asymptotic values. It is therefore of interest to interpret the long-term behaviour from early observations.

In brief, it is desired to obtain the best fit in a Gaussian, least squares sense for the constants in the expression

$$x(t)=a+b\exp(-t/c),$$

x being the stress at the elapsed time t . Several preliminary steps should be taken. The stress immediately on application of the load $x(0)=a+b$ is generally known. The asymptotic value can be roughly estimated but will be refined in the course of the regression process. The constant c has to be chosen arbitrarily initially but this too will be changed as the regression proceeds. As a matter of experience, it is desirable to plot the $x(t)$ curves at each critical stage of the regression. Again, MATLAB is well equipped to do this with a minimum of effort.

In order to demonstrate the process, I have used some experimental data made available to me that covers a period of over 81456 hours and have used the first 24 hours.

In what follows, I use MATLAB's notation

```
t=[0,1,2.25,4.8,24]; % t hours at constant deformation
```

```
x=[100,98.8,97.6,95.3,94.7]; % Percent residual force
```

According to my scheme, I first search for the value of c that will give the lowest value of $\sum (x-y)^2$ (the MATLAB expression for the sum of the squares of the differences between the observed values x and the calculated values according to

```
y=a+(100-a)*exp(-t/c)
```

for some initial guess for a . This is followed by a search for a to further reduce the least square error. The iterations are very quick and after 13 iterations I find a best fit

```
x=90.5 + 9.5*exp(-t/14)
```

The accompanying graph shows the observed values and the fit obtained from the regression. The fit is reasonable, and I am certain that 2 more iterations would improve it further. The asymptote or final relaxed stress is 90.5% of the initial stress.

My friend and colleague Prof. D. Levine has shown me that MATLAB supports a function [sse] designed to solve the least squares problem automatically by a Downhill Simplex algorithm. Use of this function is too specialized to be detailed in this note, but comparing the results obtained by [sse] and my own semi-analytic trial-and-error in the attached graph shows how superior the former is. The constants obtained are $a=94.68$, $b=5.32$, $c=3.76$ (Simplex) and $a=90.5$, $b=9.5$, $c=14$ (Rigbi).

Examination of the experimental data shows that there is a sudden drop of stress at about 6000 hours. Such behaviour is not expected of a standard rheological solid, and so the single exponential model does not apply over too long a period. It is interesting to note that such a sudden drop has been observed in other Neoprene compounds studied at the same time. Is this characteristic of Chloroprene rubber materials and does it therefore make them unsuitable for long-term sealing applications?

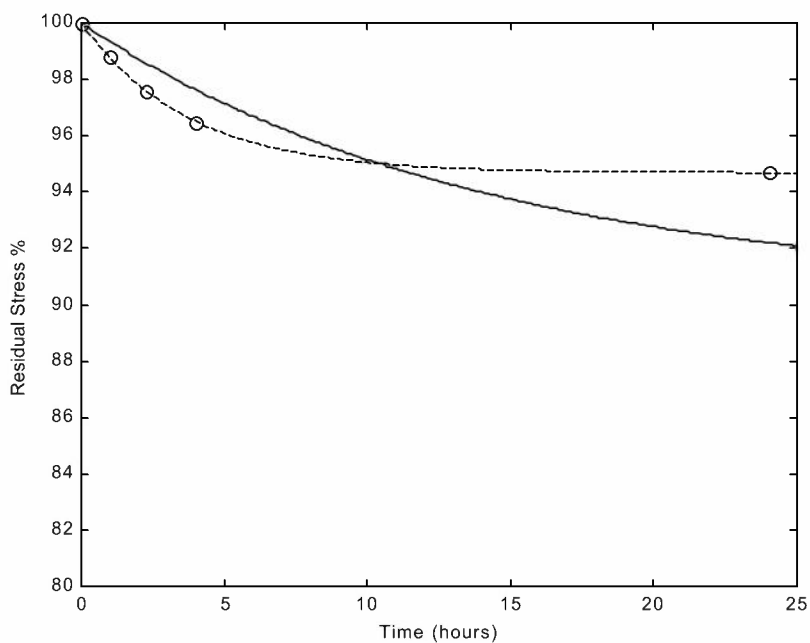


Figure 1: Comparison of fits obtained by trial-and-error (Rigbi), solid line and by simplex method, dashed line. Circles show experimental data.

Acknowledgement

I acknowledge with thanks the assistance of Prof. D. Levine in the MATLAB analysis and for introducing me to the powerful MATLAB programming language.

Z Rigbi

BSR NEWS

Commentary on 306th Council Meeting Monday June 24th 2002

Ness Gardens, north of Chester, is a delightful spot in June, with its views over the Dee estuary and out to Liverpool Bay and we had chosen to meet there because in a former life I had lived just along the road and knew it very well. Membership of a meeting being held there always entitles delegates to a visitor's ticket to view the gardens, so there was a double incentive. However, I believe only Mrs Jones was able to avail herself of the offer because the rest of us spent the day discussing council business.

For those who don't know, Arthur Kilpin Bulley was a wealthy sponsor of plant collectors, such as George Forrester, who went on expeditions to the Himalayas around the 1900s to collect seeds which Bulley subsequently offered for sale through Bee's Seeds. Bulley established a garden at Mickwell Brow, south of Neston, where plants were propagated and which became a noted attraction in the locality. On his death in 1947, his daughter gave the gardens and a substantial sum of money to the University of Liverpool. Over the years it has grown and developed, supported by an enthusiastic friends organisation, into one of the foremost botanic gardens in the UK, where important research is done and certain national plant collections are housed.

It was there that five Councillors arrived on Monday morning. Noting five apologies for absence and checking that we had a quorum (at least four members) we started, but where were Rhodri and Mike? Through the minutes and noting that despite our comments to the contrary there would be a European Rheology meeting in September 2003 and on to book reviews and concerns about the lack of information on the state of membership records... But where were Rhodri and Mike? We noted that nothing was coming from the European societies for the European issue for the Bulletin and wondered "do they really still want it?" Eirian agreed to check at the forthcoming ESR meeting in Germany. We agreed to put the Bulletin on our website, with a link from the ESR. Nick reported on Rheology Abstracts, in Gary's absence. The next issue will be a double one but had been delayed by teething troubles in the handover. We then

had a long discussion on the relative costs and value of electronic access to Rheology Abstracts and eventually concluded with a cost for outside users, i.e. non-members of the society. But where were Rhodri and Mike? The minutes writer could visualise a situation where the order of the minutes is completely different from the order of discussion.

12.50 Rhodri and Mike arrive, with a story to tell about the problems of starting a Renault Laguna (hired for the journey) with inadequate instructions about use of an electronic key.

Rhodri explains that we seem to have plenty of cash in the bank, but that subscription income is relatively invisible and that we have to tackle getting this and help Geoff however we can. One way is to use direct debits and Rhodri had enquired. Apparently it will cost 32 pence per debit but Lloyds insist on trustees (i.e. Councillors) signing an indemnity in perpetuity against Lloyds making errors. We all agreed that this was lunacy and asked him to look elsewhere.

After lunch with a nice view over the by now sunny gardens it was back to work. Mike Webster described a proposal for a student with a research interest in internet based database management to use BSR as a case study and at the same time set up the information handling systems that we need. After discussing the specification and the nature of the task we agreed to commit £10k to this.

With an eye on the clock we heard about the successful meeting in Spain, the plans for Rheometry 2 in South Wales, agreed to a travel grant and a Scott Blair scholar and made some initial decisions about a meeting in December at which the Annual Award presentation could be made. That concluded another fully packed meeting and just left me to ponder over drawing up some sensible minutes to capture what we had agreed. Still, the gardens did look nice on the way out.

Phil Banfill
September 2002.

Commentary on Lecture and Annual General Meeting

Tuesday September 17th 2002

It was always going to be a small gathering at this meeting, which had been arranged to satisfy the need to hold an AGM in September or thereabouts with the congestion of the scientific meeting diary. Council had invited Professor Jan Mewis, Catholic University of Leuven, Belgium, to give a guest lecture, to be followed by the AGM and a dinner. In fact about 20 people were treated to a tour of the important effects of polymers at interfaces on the rheology of disperse systems. Jan gave an enthusiastic presentation, reviewing such issues as steric stabilisation, hard spheres and soft spheres, effects of solvents and volume concentration. In discussing the differences when dealing with immiscible droplets in emulsions, which are of course deformable, he introduced a concept (and word) which is new to me, at least. This was compatibilisation, where a polymer, consisting of groups towards one end which have an affinity with the continuous phase and groups towards the other end which have an affinity for the droplet phase. These polymers, naturally enough, span across the interface between the two immiscible liquids and give some of the features associated with polymers adsorbed on particles to these emulsions, such as interlocking, entanglement and compression. As a cement scientist, I have to confess to not fully appreciating the subtleties of the behaviour but it was encouraging to hear that there are still plenty of unanswered questions for the new generation of rheology researchers to tackle. In concluding the session with a vote of thanks, Dr Geoff Maitland referred to Jan's talk as a tour de force and all of us who heard it had a treat. Finally, thanks must go to Dr Bill Frith for organising the event.

The programme moved swiftly on to the AGM, where formal reports of the Society's activities are recorded. Of course much of the news is reported in the pages of the Bulletin and so this note will only mention items that have not already been reported. Clearly, the Society needs a Council to manage its affairs and the nominations given in a previous issue were approved and the meeting thanked Eirian Jones, outgoing President, me, outgoing Secretary but remaining as ordinary council member, and Paul Doody, retiring from Council, for their work and welcomed Geoff Maitland, incoming President, and Tim Phillips, incoming Secretary. In his report, Eirian Jones referred to the burdens that employment puts on honorary officers and members and noted that we are still trying to set up the electronic delivery of membership services in order to ease that burden, while still providing a service which is good

value to our members. This year we have commissioned a study, to be done at the University of Swansea, into internet based database management for membership, financial, publishing etc records. This will set up the systems we need for the future.

In his Treasurer's report, Rhodri Williams referred to some of the more tiresome aspects of traditional financial accounting in the modern age, in particular the loss of standing orders as a means of guaranteeing membership income. He is exploring direct debits as an alternative to payment requests to individuals but noted the penal conditions which one bank, at least, attached to such activities. The meeting agreed to the proposal to change the financial year to align with the calendar year, which will assist with providing a more accurate and timely view of the true state of membership finances. Following discussion of the possibility of amending the membership subscription rates to deal with the opportunities presented by electronic service delivery, it was agreed to hold an extraordinary general meeting in December. By the time this commentary appears in print members may already have received communications about this.

As Secretary, I was pleased to be able to report on awards of travel grants made to students, whose reports will have appeared in these pages, and of a Scott Blair Scholarship to Stephen Cordy, University of Wales, Swansea, who is studying the application of extensional flow to mobile liquids using a filament stretching rheometer. Additionally, the Annual Award this year will be made to Professor Malcolm Mackley at a joint event with the Institute for Non-Newtonian Fluid Mechanics in Aberystwyth on December 9th. Also it is hoped to have the Society's new venture, *Reviews of Rheology*, ready for publication early in 2003 and Ken Walters and David Binding are to be congratulated for driving that forward. As soon as a pricing structure has been agreed, publicity material will be distributed.

Unfortunately we were only able to have brief reports presented by the other officers in their absence for different reasons. Both Oliver Harlen and Gary Tucker mentioned the steep learning curves that they had ascended as Bulletin and Abstract Editors, but we appreciate their efforts in producing the high quality publications. Oliver particularly noted the lack of material coming from the European societies for inclusion in the European editions of the Bulletin, while Gary would be glad to receive more abstracts from any suitable sources.

In closing the meeting, Geoff Maitland paid tribute to the successful Presidency of Eirian Jones and looked forward to being able to tackle several important issues in the next couple of years.

Many of those present completed the evening with dinner at a good restaurant in Bloomsbury at which matters more or less formal were discussed alongside practical investigations of food texture and rheology as well as the effect of trace components on the flow of water-alcohol mixtures.

Phil Banfill
September 2002.

Officers Reports to the BSR

62nd Annual General Meeting

The President's report

During the past year most of the Council discussions have involved the future role of the society and how present state of the art electronic technologies can improve our service to our members. However, before presenting the outcomes of these discussions, I believe that the most important decision reached by the Council this year was to support a proposal made by Council member Dr David Binding to produce a Review of Rheology which will be published annually. The first guest Editor will be Professor K Walters, with Dr D Binding as the second Editor, concerned with the day to day running of the publication. A range of eminent rheologists, including Professors Howard Barnes, David Boger, Tom McLeish, Gerry Fuller and Roland Keunings, have been approached and most have agreed to contribute to the first issue which was advertised during the 6th European Congress of Rheology at Erlangen. This first issue of the review should be available by the end of the year.

The BSR were involved in various conferences this year and the first 'Complex materials in External fields' was held at the University of Manchester last September. The conference was organised by Dr Andrew Masters of the Department of Chemistry and was a joint meeting with the Statistical Mechanics and Thermodynamics Group of the Royal Society of Chemistry and the Institute of Physics. There were 45 registered participants and the organising committee, of which Dr O Harlen was our representative, is to be congratulated on a well organised conference and

the impressive line up of distinguished speakers. At the conference dinner the Annual award was presented to Professor H Barnes OBE of Unilever Research for over thirty years of distinguished service to Rheology. This year the Annual award will be made to Professor Malcolm Mackley and will be presented at the Institute of Non-Newtonian Fluid Mechanics Annual Lecture at Aberystwyth in December.

In April the BSR contributed to the Lake Vyrnwy conference on Process Modelling organised by the University of Wales Institute of Non-Newtonian Fluid Mechanics. The conference was fully subscribed and the organisers are to be congratulated again on a very impressive line up of speakers, including several notable rheologists from the USA, Korea and Australia as well as a good representation from Europe.

The BSR were closely involved (our representative was Dr N Hudson) in the organisation of Eurorheo 2002-01 held at Torremolinos, Spain in April. This conference was preceded by the 8th European School of Rheology, Rheology for the Process Industries, which was attended by about thirty students. The main conference had over 200 delegates and the participating British, Spanish, Italian and Portuguese Societies are to be congratulated on a very well organised conference. A range of very interesting keynote lectures were presented, as well as other very informative talks presented at two parallel sessions. The guided excursion to Granada, followed by the banquet, was very much enjoyed by all the delegates.

In September the 6th European Conference on Rheology was held at Erlangen in Germany with over 350 delegates from over 40 countries. The highlight was the award of the Weissenberg Medal to Professor Ken Walters of the University of Wales Aberystwyth, UK. His award lecture demonstrated his important and significant contributions to both theoretical and experimental Rheology research over the last forty years. A meeting of The European Society of Rheology committee was held during the conference with the main item for discussion being the proposal by the executive committee to hold Annual European Rheology conferences. Some reservations were expressed by some societies but the motion was carried by a substantial majority. The ESR committee also expressed an interest to have closer connection between our respective web sites. Discussions will be taking place during the coming year.

In September Professor J Mewis of K.U. Leuven was our guest speaker at a mini symposium held at the SCI in London. He presented a very

interesting talk on 'Rheological effects of polymers at interfaces' This talk was followed by our AGM.

With regard to future conferences I would like to draw your attention to the 'Rheometry II' Institute of Non-Newtonian Fluid Mechanics/British Society of Rheology conference which will be held at Miskin Manor near Cardiff next April. Also the first Annual European conference will be held in Guimares next September under the auspices of the Portuguese Society of Rheology

With regard to Council matters we have negotiated formal agreements with our outside service providers and I hope that this will overcome some of the problems associated with providing our publications to our members. As I mentioned previously we have discussed at length how to provide a better service to our members. To this end we have decided to commission a study at the University of Swansea under the control of Prof. Mike Webster to modify our website so that all our publications can be accessed electronically. Another factor is the burden placed on our officers by the demands of the society. So a further aim will be to hold all membership details and, with sufficient protection, also the subscription records which should vastly improve the efficiency of the Society. The Canadian Society as well as other societies have made enquires about purchasing both the Bulletin and Abstracts. These electronic developments should make this possible without losing control of our main assets, namely our publications.

Finally I would like to thank the Council for all their considerable efforts this year. My thanks to Paul Doody, who is leaving Council this year, for his dedication during his time as Bulletin Editor and afterwards as a member of Council. By the way Paul was our first Scott Blair Scholarship recipient. My thanks also go to Phil Banfill who is finishing his period of office as secretary but will continue as a Council member. His quiet advice, expertise and knowledge of council procedures certainly made my job as President very much easier. I have very much enjoyed my time as President and I would like to wish the new President and Council all the best for the future.

Eirian Jones
September 2002

Hon. Secretary's report

In another busy year for meetings, following the joint meeting with the Royal Society of Chemistry subgroup on the theme of colloids and soft

matter in Manchester last year, we supported the spring meeting of the Institute for Non-Newtonian Fluid Mechanics at Lake Vyrnwy and collaborated with the Spanish, Portuguese and Italian societies in a conference on rheology theory and applications, held in Torremolinos in April 2002, together with the European School of Rheology. In view of the full timetable of meetings in September 2002 we decided upon the present invited lecture and AGM rather than a full conference. We are planning a half day meeting in Aberystwyth in December 2002 which will also include the presentation of the 2002 Annual Award to Malcolm Mackley.

Council has met three times to manage the affairs of the Society and has discussed the publication of a new annual review of non-Newtonian fluid mechanics which is well under way, with a launch date provisionally set for April 2003. We have also spent a lot of time discussing electronic service delivery and web based access to information, such as the Bulletin and Rheology Abstracts. We have agreed to fund a research student to develop these activities further.

We have made a couple of travel grants to students this year. We approved Natalia Fava, Plymouth, to attend the conference in Spain, but in the event she was unable to go due to illness. We supported Michaela Stolbova of the University of Strathclyde to attend the same conference and Richard Graham of the University of Leeds to attend the Conference of European Rheologists in Erlangen. As always, we are keen to receive more applications from students, and would like to encourage supervisors to promote the awards to their students. Finally, it is particularly gratifying that, after a long period without one, we have been able to award a Scott Blair scholarship to Stephen Cordy from the University of Wales, Swansea, who is studying the application of extensional flow to mobile liquids using a filament stretching rheometer.

On a more sombre note we received news during the year of the death of Vernon Harrison, one of the three founding members of the Society in 1940. He was dedicated to the Society and that dedication extended to the bequest of a small legacy, suitable uses for which will be considered by the Council. This year also marks the centenary of the birth of George Scott Blair, another of the founding trio.

I would like to conclude by thanking all the Officers and Council Members who have worked hard for the Society this year, particularly mentioning Paul Doody who stands down at this AGM having joined the Council in 1994 as a way of saying thank you for his Scott Blair scholarship and along the way completed a term of office as Bulletin

Editor. As I complete my own term of office as Secretary, I would like to welcome my successor nominee, Tim Phillips, and look forward to working with him over the next few years.

Phil Banfill

September 13th 2002

Hon Bulletin Editor's Report

This year was my first as Bulletin editor, and despite much help from my predecessor, Paul Doody and publications manager, Nick Hudson it was still quite a steep learning curve. This has caused a slight slippage in publication dates, which I aim to correct next year.

I would like to thank those members and others who contributed to the Bulletin this year. These contributions help to maintain the variety within the Bulletin's content. In particular, I would like to thank Dorle Potton and Howard Barnes whose articles provided the main part of the Bulletin's tribute to Scott Blair on the centenary of his birth. I would like to encourage others to submit articles to Bulletin, whether scientific or historical, that may be of interest to the rheological community.

I would also like to thank our advertisers for their continued support of the Bulletin. This year I we increased the rates for advertisements slightly, the first rise since 1998. However, I believe the Bulletin still provides excellent value for money for advertisers.

Two of the three Bulletins in each year incorporate the Newsletter of the European Society of Rheology. However, there has not been much content provided by other European societies recently and so I think this arrangement should be reviewed.

Finally, in response to a comment made at last years AGM on the quality of photographs in the Bulletin, I am happy to report that all the photographs in the latest bulletin are in sharp focus. However, the credit for this improvement should go to Nick Hudson and not me.

Oliver Harlen

13th September 2002

**A Joint Meeting of the
British Society of Rheology
and the
University of Wales Institute of Non-
Newtonian Fluid Mechanics**

To be held at the University of Wales Aberystwyth in the Cinema of
the Arts Centre

Monday, December 9th, 2002

14:15 Address by the President of the British Society of Rheology,

Professor Geoffrey C Maitland (Schlumberger Cambridge Research, UK)

**FROM MUD TO WORMS..... THE RHEOLOGY OF
HYDROCARBON RECOVERY**

14:45 Citation for the 2002 Annual Award of the British Society of Rheology and Presentation of the Award.

**14:50 Chair: Prof. G C Maitland
Presentation by the recipient of the 2002 Annual Award.**

Professor Malcolm R Mackley (University of Cambridge, UK)

**GAS ASSISTED MICRO CAPILLARY POLYMER
EXTRUSION**

15:20 Coffee

15:45 Chair: Prof K Walters. The University of Wales Institute of Non-Newtonian Fluid Mechanics Annual Lecture Professor David V Boger (University of Melbourne, Australia)

ENVIRONMENTAL RHEOLOGY

An Extraordinary General Meeting of the British Society of Rheology will be held at 17:00 in the Physical Sciences Building, University of Wales Aberystwyth.

Reasonably priced lunches may be obtained in the Arts Centre if required.

Anyone wishing to attend Dinner at the Conrah Hotel, in the evening of December 9th, should contact Prof. Tim Phillips regarding arrangements and payment.

(E-mail: tnp@aber.ac.uk , Tel: 44 (0) 1970 62769)

AIMS OF THE SOCIETY

The way liquids flow and solids deform affects all aspects of life.

Extraction and processing of crude oil, moulding of plastics, use of toothpaste, spreading of margarine, painting and the lubrication of joints in the human body are all examples of processes depending upon rheological behaviour. Rheology is defined as the science of the deformation and flow of matter.

If your work is concerned with rheology in any way, then you have much to gain by joining the British Society of Rheology - publications, conferences and access to fellow members who, while working in a different discipline or industry, may be facing similar problems to yours.

The Society is non-profit making and is registered as a charity.

Other Conference Announcements

Annual European Rheology Conference 2003, AERC 2003

The Portuguese Society of Rheology and the Department of Polymer Engineering of the University of Minho are pleased to announce the organisation of the first Annual European Rheology Conference 2003, AERC 2003, to take place in Guimarães, Portugal, in the period September 11-13, 2003.

AIMS AND SCOPE

The aim of AERC 2003 is to contribute to the advancement of Rheology in Europe, by bringing together researchers from both within and outside Europe, in a meeting of broad scientific scope but focussed on the presentation of novel, recent high-quality scientific results. Special attention will be given to fostering fruitful discussions between participants and promoting the participation of young researchers.

CONFERENCE FORMAT

The AERC 2003 will have a 3-day duration and will be split into topical Symposia, focussed either on mainstream or upcoming areas of Rheology. Each Symposium will have two Chairpersons, who will be renowned experts in the field, and will be in charge of organising its scientific programme (selection of mode of presentation, organisation of sessions, etc.).

The conference will have Plenary, Oral (in parallel sessions) and Poster contributions, paper submission and registration being done electronically over the WWW.

The confirmed list of Plenary speakers is the following:

H. M. Laun , R. Keunings, G. Marrucci,
M. M. Denn, E. Windhab, T. Sridhar,
I. Emri

The deadline for abstract submission will be kept very close to the conference (see below for details). Also, in order to promote the presentation of high-quality results, special issues of both *Rheologica Acta*

and Journal of Non-Newtonian Fluid Mechanics, containing contributions selected from each Symposium by the respective Chairpersons, will be edited after the conference.

LOCATION

Guimarães is an attractive city in the north of Portugal, located about 50 Km from the Francisco Sá Carneiro International Airport in Oporto and directly linked to it by motorway (A3 and A7). It is located in the verdant region of Vale do Ave, in the heart of the province of Minho, 40 Km away from the beautiful National Park of Gerês and 50 km away from the Atlantic Ocean and its beaches.

In the twelfth century, when the nation was founded, Guimarães was the first capital of Portugal, and today it still maintains the Historic Centre, which has been duly rehabilitated and represents the principal cultural and tourist attraction of the city, having been awarded the status of World Heritage of Humankind by UNESCO on December 13, 2001.

In mid-September the weather conditions in the region are usually mild, with sunny weather and average daytime temperatures between 20 °C to 30 °C.

IMPORTANT DATES

Deadline for submission of Oral presentations: May 15th, 2003

Notification of acceptance: June 15th, 2003

Deadline for submission of Poster presentations: July 15th, 2003

CONTACTS

For more information, please contact:

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The XIVth International Congress on Rheology

August 22 ~ 27, 2004

COEX Convention Center,
Seoul, Korea

Call for Papers

Authors are invited to submit abstracts (each not exceeding 300 words) for either oral presentations or poster presentations. Abstracts should be submitted to the Congress Secretariat no later than September 30, 2003. On-line Abstract Submission via Congress Website (www.icr2004.or.kr) is highly recommended.

Authors will be notified of the acceptance of their papers/posters by January 31, 2004, and then requested to submit the manuscripts no later than March 31, 2004 for the publication of the proceedings in CD Rom. The manuscript will be included in the proceedings only if accompanied by the early registration of the paper/poster presenter.

The topics and the organizers of the Mini-Symposia are below and the presentations will be grouped according to the subject categories by the Scientific Committee.

Mini-Symposia	Organizers
Computational rheology	Prof. A N Beris, Prof. N Phan-Thien
Flow instability	Prof. S G Hatzikiriakos, Prof. E G Shaqfeh
Foams, emulsions & surfactants	Dr. A M Kraynik, Prof. L G Leal
Foods & biomaterials	Prof. H A Barnes
Materials processing	Prof. D G Baird, Prof. J A Covas, Prof. J M Piau
Microstructural modeling	Prof. R G Larson
Nanorheology & microfluidics	Prof. G G Fuller, Dr. Sangtae Kim
Non-Newtonian fluid mechanics	Prof. O Hassager, Prof. G H McKinley
Polymer melt	Prof. P Moldenaers, Prof. M H Wagner, Prof. H Watanabe

Polymer solutions	Prof. S J Muller, Prof. T Sridhar
Rheometry & experimental methods	Prof. M R Mackley, Prof. R K Prud'homme
Solids & composites	Prof. G B McKenna, Prof. H H Winter
Suspensions & colloids	Prof. D V Boger, Prof. H Usui
General papers	Prof. J C Hyun

Important Dates

Deadline for Abstract Submission	September 30, 2003
Notification of Acceptance	January 31, 2004
Deadline for Manuscript Submission	March 31, 2004
Deadline for Early Registration	April 30, 2004

Social Program

The Organizing Committee is to prepare interesting and enjoyable social programs for all the participants of the ICR2004 to give special memories and cultural experiences during their stay in Korea. A half-day excursion to Kyungbok Royal Palace including the adjacent National Museum is an example. Various pre- and post-conference tour programs are also recommended to the participants for their further enjoyment in Korea.

Congress Secretariat

The Korean Society of Rheology
Rm. 806, New Bldg., The Korea Science & Technology Center
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Website: <http://www.icr2004.or.kr>



THE AMERICAN SOCIETY OF MECHANICAL
ENGINEERS

Flows in Manufacturing Processes

July 6-10, 2003, Honolulu, Hawaii

The Fluid Mechanics Technical Committee (FMTC), the Coordinating Group in Computational Fluid Dynamics (CGCFD), and the Fluids Applications and Systems Technical Committee (FASTC) of the Fluids Engineering Division of the ASME are jointly sponsoring a symposium on Flows in Manufacturing Processes. Papers enhancing our understanding of the fluid dynamics of such processes, via analytical, experimental and numerical simulations, are sought. Studies of all types of manufacturing processes involving Newtonian or non-Newtonian fluids under isothermal and non-isothermal conditions are welcomed.

Prospective authors are requested to submit an abstract to one of the organizers listed below. A full manuscript is to be submitted for review according to the attached schedule. Accepted final manuscripts will be published in the Proceedings of the 2003 FEDSM, and have to be prepared according to the ASME standard format for a conference paper.

DEADLINE SCHEDULE

Abstract due:	Passed
Full length draft manuscript due:	November 2, 2002
Author notification/Instructions:	January 4, 2003
Camera-ready papers due to organizers:	February 22, 2003

ORGANIZER

Professor Patrick Bourgin
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**UNIVERSITY OF WALES
INSTITUTE OF NON-NEWTONIAN FLUID MECHANICS**

CONFERENCE ON RHEOMETRY

Miskin Manor Country House Hotel, Cardiff, Wales U.K.

April 14 – 16, 2003

Programme

The conference will commence at 12 noon on Monday April 14th, 2003 and finish at lunchtime on Wednesday April 16th, 2003.

The emphasis will be on advances in rheometrical theory, experimentation, instrumentation and the treatment and interpretation of data. The conference will include an instrument exhibition and the programme will feature a general debate on the current status of “the yield stress”, led by Professors Barnes and Boger. A Special Issue of the Journal of Non-Newtonian Fluid Mechanics will be devoted to the Proceedings, with the Organizing Committee, Prof. Ken Walters, F.R.S. and Prof. P. Rhodri Williams, as Guest Editors.

Plenary speakers include Prof. G H McKinley (M.I.T.), Prof. G G Fuller (Stanford), Prof. H A Barnes (Unilever Research), Prof. D V Boger (Melbourne), Prof. T E R Jones (Plymouth).

Venue

The meeting will be held at the Miskin Manor Country House Hotel, which is set in 22 acres of countryside, 15 minutes from Cardiff and 25 minutes from Cardiff (Wales) Airport. The hotel offers excellent dining, accommodation and conference facilities. The conference fee includes access to the hotel's health club. Early registration for accommodation at Miskin Manor is advised due to high anticipated demand. Alternative accommodation (with local transport to and from the conference) will be provided at the nearby Cophthorne Hotel.

Costs

The total cost of £350 includes full-board accommodation from Monday lunch to Wednesday breakfast. An accompanying person, sharing a room with a conference delegate, will be required to pay £100.

MULTIPHASE FLOW 2003

Second International Conference on Computational Methods in
Multiphase Flow, 3 - 5 November 2003, Santa Fe, New Mexico, USA

The success of the first international conference on multiphase flow, held at the University of Central Florida in 2001, has led to the reconvening of the meeting in Santa Fe in 2003. Fluid dynamics is a main topic of applied mathematics and physics, with its study being one of the most challenging areas of computational mechanics.

The conference will focus on new advanced numerical methods and computer architectures, which greatly improve the ability to solve complex multiphase flow problems.

The Proceedings of this conference will be published in hard cover book form by WIT Press and will be available to delegates at the time of registration.

Topics

Multiphase flow and heat transfer	Emulsions
Multiphase flow in porous media	Interfacial phenomena
Multiphase flow of non-Newtonian fluids	Parallel computing algorithms
Multiphase flow systems	Particle-flow interaction
Bubble and drop dynamics	Stratified fluids
Bubble flows	Suspensions
Cavitation	Effects of external force field
Viscous and density instability	

Papers are invited on the topics outlined above and others falling within the scope of the meeting. Abstracts of no more than 300 words should be submitted by mail, fax, email or via our website as soon as possible, but no later than 7th of January, 2003.

Enquiries to: Stacey Hobbs , Conference Secretariat , MULTIPHASE FLOW 2003, Wessex Institute of Technology ,Ashurst Lodge, Ashurst Southampton, SO40 7AA, Tel: 0238 029 3223 Fax: 0238 029 2853
Email: enquiries@wessex.ac.uk
Conference Website:
<http://www.wessex.ac.uk/conferences/2003/multiphase2003/index.html>

RECRUITMENT OPPORTUNITIES

A range of opportunities may be found at <http://www.bsr.org.uk/> or on the ESR website <http://www.esr-rheology.org/Jobs>

For example:

Marie Currie Fellowship – Institute of Chemical Engineering and High Temperature Chemical Processes (ICE/HT-FORTH)

The research project will focus on the development of efficient numerical algorithms for the simulation of high throughput flows and instabilities for non-Newtonian viscoelastic fluids. Continuum-level finite element-based methods will be developed to simulate processes such as fiber spinning, injection moulding and film blowing. Emphasis will be placed on the numerical simulation of PE (and modified PE) melt extrusion at intermediate and high shear rates where stick-slip instabilities prevail. In the simulations, molecular-based mechanisms leading to couplings between applied shear stress and slip phenomena at the polymer/substrate interface will be accounted for.

Applicants must: hold a Ph.D. degree in Physical or Engineering Sciences, have a nationality of one of the EU Member or Associated States different than Greek, and be 35 years old or less.

The duration of the scholarship is for one to two years, and the total allowance (including mobility allowance) is 3500 EURO/month. Applicants should send a C.V., a publication list, a statement of research interests and accomplishments, and arrange for three letters of reference to be sent to:

Dr. Vlasios Mavrantzas, ICE/HT-FORTH, Stadiou Street, Platani, Patras GR 26500, Greece,

tel.: (+30-610) 965-214, FAX: (+30-610) 965-223,
e-mail: vlasios@iceht.forth.gr

and/or Prof. John Tsamopoulos, University of Patras, Department of Chemical Engineering, Patras GR 26500, Greece,

tel.: (+30-610) 997-203, FAX: (+30-610) 993-255,
e-mail: tsamo@chemeng.upatras.gr

INDUSTRY NEWS

THERMO HAAKE – FREE SAMPLE MEASURING OFFER

Thermo Haake announces a worldwide marketing initiative to promote its new optical rheometer, the RheoScope 1. This instrument launched in September 2001 is a high-end rheometer with an integrated microscope and video camera. The possibilities resulting from this combination open new horizons for research and practical applications. Images of shear-induced structural changes can be recorded and correlated with the rheological properties of the sample under shear.

Thermo Haake offers users the possibility to have two samples measured with the RheoScope for free. Applicants must fill out the online form, accessible via the RheoScope webpage (www.thermo.com/rheoscope). After registration, applicants will be contacted by their local Thermo Haake representative who will advise them on where the samples should be sent. After completion of the tests a CD containing all the results including videos and images will be returned to the user for evaluation.

For more information visit: <http://www.thermo.com/rheoscope>

PAAR PHYSICA – AUTOMATIC SAMPLE CHANGER ASC 16/32

Complicated sample preparation and tedious cleaning procedures are now things of the past thanks to Paar Physica's second generation automatic rheometer system. Featuring automatic testing of up to 32 samples, the new system helps boost laboratory productivity while reducing errors in sample handing and analysis.

Ideal for fluid applications such as cosmetics, paints, agrochemicals, pharmaceuticals, and food, the ASC features a temperature controlled sample magazine with either 16 or 32 measuring cups, which are easy to remove from the magazine and simple to clean. Each cup remains sealed until the measurements begin, so volatile components won't evaporate, and samples won't dry out.

For many materials, consistent, uniform sample preparation is the key to reproducible measurements. The high-precision mechanics of the ASC coupled with flexible, intuitive software guarantee the reproducibility of each step in the measuring sequence. The system can perform dynamic

oscillation experiments in addition to standard viscosity measurements, and can be configured with any of the rheometer drives featured on the MC1 and MCR series laboratory instruments.

Special emphasis has been placed on cleaning the measuring bob, with fully automatic cleaning cycles selectable through software. Cleaning cycles can include mechanical pre-cleaning of the measuring bob, wet scrubbing with solvents and automatic drying with compressed air.

With its full range of automation possibilities, the ASC also allows for 24 hour operation, and can be controlled via an external application using the "LIMS/SAP" interface used for robotic measuring devices. To see how an ASC can help reduce your cost per measurement while increasing precision and accuracy in your lab, contact Paar Scientific at 0208 5408533, email goodyer.s@psl.anton-paar.co.uk , or visit our web site at <http://www.paar-scientific.com>

STOP PRESS - TAKEOVER

Late breaking news! As we go to press, it has been announced that TA Instruments has just taken over Rheometric Scientific, to form (probably) the world's largest rheological equipment manufacturer and distributor. Watch this space for more information.

CONFERENCES

You are also advised to visit the BSR home pages where an extensive list of conferences is maintained by Chris Petrie: <http://www.bsr.org.uk/>

2003	
9-13 Feb Zurich Switzerland	3rd International Symposium on Food Rheology and Structure Info: www.isfrs.ethz.ch E: secretary@isfrs.ethz.ch
14-16 Apr Cardiff Wales	Rheometry II Dr Rhodri Williams E: p.r.williams@swansea.ac.uk
4-7 June Lausanne Switzerland	XIIIth International Workshop on Numerical Methods for non-Newtonian Flows Robert Owens, LMF-IE-FSTI, Ecole Polytechnique Fédérale de Lausanne, CH 1015 Lausanne, Switzerland. T: +41 21 693 3589 F: +41 21 693 5307. Info: lmfwww.epfl.ch/IWNMNF2003 E: wkshop2003@epfl.ch
22-26 June Sofia Bulgaria	12th European Conference on Clinical Hemorheology E: antonova@imbm.bas.bg Info: www.12ECCH.primasoft.bg
6-10 July Honolulu USA	FLOWS IN MANUFACTURING PROCESSES Advances in Materials Processing Science Info: www.engr.twsu.edu/DrSiginer/asmehawaii.htm T: 1 316 978-3400, F: 1 316 978 3853 E: siginer@engr.twsu.edu
7-10 July Melbourne Australia	PPS-19 POLYMER PROCESSING SOCIETY Info: www.pps19.nwww.com.au E: pps19@rmit.edu.au
11-13 Sep Guimaraes Portugal	AERC 2003 Annual European Rheology Conference Info: www.rheology-esr.org/AERC2003 E: jmaia@dep.uminho.pt
7-10 Oct Lake Placid USA	4th International Conference on Mechanics of Time Dependent Materials E: sem@fs.uni-lj.si Info: www.uni-lj.si/~cem/mtdm03

2003	
3-8 Nov Sendai Japan	3rd International Symposium on Slow Dynamics in Complex Systems Info: http://www.ifs.tohoku.ac.jp/slow-dynamics/
3-5 Nov Santa Fe USA	Multiphase Flow 2003 Info: www.wessex.ac.uk/conferences/2003/multiphase2003/index.html E: enquiries@wessex.ac.uk T: 0238 029 3223 F: 0238 029 2853
4-6 Nov Santa Fe USA	Moving Boundaries 2003 Info: www.wessex.ac.uk/conferences/2003/movingboundaries2003/index.html E: enquiries@wessex.ac.uk T: 0238 029 3223 F: 0238 029 2853
5-7 Nov Santa Fe USA	Materials 2003 Info: www.wessex.ac.uk/conferences/2003/materials2003/index.html E: enquiries@wessex.ac.uk T: 0238 029 3223 F: 0238 029 2853
2004	
22-27 Aug Seoul Korea	XIV INTERNATIONAL CONGRESS ON RHEOLOGY Info: www.icr2004.or.kr E: icr2004@icr2004.or.kr
T: Telephone; F: Facsimile; E: Email; Info: WWW URL	

COURSES

2003	
24-25 Mar Malmo Sweden	Basic Principles of Colloid and Interface Science and their Applications CALMIA AB / Mrs Gunlög Tånge, Box 2161, SE-220 02 Lund, Sweden T/F +46 46 211 00 20 calmia@calmia.se
5-6 May Malmo Sweden	Principles of Rheology and its Measurement Techniques CALMIA AB / Mrs Gunlög Tånge, Box 2161, SE-220 02 Lund, Sweden T/F +46 46 211 00 20 calmia@calmia.se
8-9 May Leicestershire UK	RHEOLOGY WORKSHOP Steve Goodyer, Paar Scientific Ltd, 594 Kingston Rd., Raynes Park, London SW20 8DN T: +44 (0) 208 5408553; F: +44 (0) 208 5438727 E: goodyer.s@psl.anton-paar.co.uk
12-13 May Malmo Sweden	Dispersion of Powders in Liquids and Stabilization of Suspensions CALMIA AB / Mrs Gunlög Tånge, Box 2161, SE-220 02 Lund, Sweden T/F +46 46 211 00 20 calmia@calmia.se

2003	
19-20 May Malmö Sweden	Disperse Systems in Pharmaceutical Formulations CALMIA AB / Mrs Gunlög Tånge, Box 2161, SE-220 02 Lund, Sweden T/F +46 46 211 00 20 calmia@calmia.se
2-6 Jun Glasgow UK	Theoretical, Experimental and Industrial Aspects of Rheology Dr NE Hudson, Dept P&A Chemistry, University of Strathclyde, 295 Cathedral Street, Glasgow, UK T: +44(0)141 5482162; F: +44(0)141 5484822 E: n.e.hudson@strath.ac.uk
3-7 Nov Glasgow UK	Process Rheology Dr NE Hudson, Dept P&A Chemistry, University of Strathclyde, 295 Cathedral Street, Glasgow, UK T: +44(0)141 5482162; F: +44(0)141 5484822 E: n.e.hudson@strath.ac.uk
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