



Editor's Corner

A New Era for FERG

Welcome back to the FERG fold after the summer recess.

I hope you all had an excellent summer.

This autumn beckons in a new era for FERG. The merger of the two engineering schools and the formation of the Design and Technology Faculty opens up new possibilities for FERG. The group has always had a pretty diverse membership, with representatives from the old Mechanical School, Information & Media, Applied Science, Industry, etc. However, there has always been an assumption of engineering bias. With the new faculty structure, we have the opportunity to expand the membership, not only in numerical terms, but also in the range of disciplines.

There used to be an advert for the Institute of Chemical Engineers along the lines of the old "Lipsmacking" Pepsi advert which started with the phrase "If you don't use..." followed by a list of common and extraordinary items, finishing up with "then you don't use Chemical Engineering". This applies too to the range of disciplines that are involved in fluids and environmental research. Each discipline brings with it a different viewpoint, but very often the problems are the same. The processing of chocolate mousse carries with it many of the same problems as extracting oil!

FERG was started about 5 years ago with the aim of getting researchers and staff within the School of Mechanical & Offshore Engineering to communicate their ideas and help each other out with any obstacles encountered in their research. The hope is that now we can do the same within the wider Faculty and the University as a whole. This newsletter started, three years ago, as a meagre slip of paper to 15 members of FERG. Now it goes to 30 members, Heads of School, Deans of Faculty, the Principal's Office and the Head of the Board of Governors. The purpose of this wide distribution is so that people across the university spectrum can see the success of FERG and the rich vein of research interests from which we draw.

FERG has also an involvement with local industry and has had many interesting presentations on the challenges they face. By expanding the discipline range of FERG, our eyes can be opened to new challenges.

OK, that's the evangelical bit over! OPT-Current - the economic and electrical optimisation of tidal current

turbines - is nearly over. Ian and I are now into the task of compiling all the reports and data for the final report. The optimisation routines written by me have been enhanced by a brilliant GIS front end produced by Yann Delure from University College Cork. The fat lady should sing sometime during November.

The actual toolbox will be an on-going development, with scope for the incorporation of new tidal turbine technologies and the interface developing to give better information to the tidal turbine farm developer. A demonstration version is also being considered for use at such events as Techfest, Satrosphere, and Aberdeen Science week.

I'd better get on with the final report now. See you all at the next meeting.

Guy T Melville
Convenor

BABS' CORNER

Underbalanced drilling (UBD), rather than being seen as an expensive niche technology, has the potential to become the best alternative to conventional overbalance drilling technique. As we strive to exploit the oil/gas reservoirs in deeper waters, the use of conventional drilling technique with a single pressure gradient mud in a dual gradient environment compromises safety especially with the prospect of a potential blowout among other problems. UBD therefore has the potential to be an attractive option in minimising any potential problem as we continue to explore into the deepwaters of the Atlantic Margin, Gulf Coast, Campos Basin and West Africa.

For operating companies to find the expensive UBD attractive however, there must be evidence of a net payback and Return on Investment (ROI) through improved and sustainable recovery from the oil/gas reservoirs. This is the rationale behind our newly initiated JIP project on UBD titled: "A study of productivity improvement mechanisms in underbalanced drilling". The preliminary thoughts on this project were presented recently at:

- (i) The Ferg Meeting of June, 2001
- (ii) The European Drilling Engineering Association(DEA) Forum on UBD at Pau, France ,June 2001

A poster presentation was also made on these preliminary thoughts and other well engineering research activities in RGU at the last DTI Improved Oil Recovery research dissemination seminar held in London on 29th June, 2001.

The preliminary studies carried out over the last few years at Heriot-Watt and especially here at RGU through dedicated student-centred mini-projects have improved our knowledge base of the complex interface between downhole well operations and reservoir performance during underbalanced drilling. This experience will be very valuable to the new JIP project, which is being sponsored by the DTI under its ACHARR (Advisory Committee on hydrocarbon Additional Recovery Research) programme. More details on this project will be provided at a later date.

To enhance my geoscience knowledge, I also, for the first time, participated in the 50th EAGE (European Association of Geoscientists and Engineers) conference held in Amsterdam from 5th to 7th June, 2001. It was quite refreshing to exchange ideas with the ‘‘rock docs’’.

According to a recent forecast, the average age of oil industry personnel is expected to rise to 50 years in the year 2007. This is causing major concern in the industry worldwide and the drive to attract young people to the industry has started in earnest. ‘‘Winning the Talent War’’ was the appropriate theme of two round table panel discussions which I participated in over the summer. They are:

- (i) The SPE Conference held in Abuja, Nigeria from August 5th to 9th, 2001 during which the future of Petroleum Engineering Education in Nigeria was discussed.
- (ii) The Offshore Europe Conference held from September 4th to 7th, 2001 during which issues on strategies for attracting young students to become the well engineers of tomorrow were discussed.

The current international crisis permitting, I may be off to Tripoli, Libya in mid-October to give a

presentation at the Mediterranean Petroleum Conference (MPC 2001) on ‘‘ Formation Damage Aspects of Depressurisation in Clastic Reservoirs’’.

For those who might be interested in having a look, I have the CD-ROM and hard copies of:

- (i) The DTI IOR Seminar Proceedings
- (ii) The SPE Nigeria Conference Proceedings
- (iii) The EAGE Proceedings

Just stop by! Who knows I might even offer you a cup of coffee!

That’s All Folks!

Dr. B

The Pentland Firth Experience

I have spent the last few months writing and amending the phase 1 report for the Pentland Firth Tidal Energy Feasibility Study. It has not been an easy task and more often than not I have taken on my colleagues role of screaming at the screen!! (You know who you are!). While waiting for added contributions I am at present in the very last stages, with just the ‘nitty-gritty’ bits to complete.

It has been an enjoyable task, with a couple of prize visits to the Orkney Isles and the north coast of Scotland. The last entailed a ‘bumpy’ and wet trip in a motor-powered rib across the firth. It was great to see the stretch of water at close hand.....too close at some points! Its such a shame I haven’t a wee picture of Colin and myself all dolled up in our wet-weather attire. We promised each other no pictures would be taken.....kind of says it all really.....we felt and probably looked liked a pair of total planks!

Despite the enjoyable side of things, working on the project has been a learning experience and an opportunity to develop and acquire new skills. It has enhanced my understanding of my PhD study area, but has also left me with more questions than I started with. The project highlighted a number of generic research areas that are paramount in the R&D of tidal current energy, as well as some site-specific areas of concern. It is hoped that the continued research within the scope of my PhD and other projects will help in some way by answering some of

the issues concerned.

My PhD resumes as of this month but will hopefully run parallel with a continuation of my RA contract. This is the result of the possible culmination of two opportunities, which have arose over the last couple of weeks. DTI and ETSU have accepted a proposal for a 2-month project to scope for a larger project in 2002. This will directly involve research into the environmental impacts of tidal current energy. This is a fantastic opportunity and is expected to involve a monitoring programme with respect to the experimental deployment of the MCT Ltd. and IT Power Ltd. tidal energy device down in Lynmouth, Devon next spring.

Other work was also put forward by the Engineering Business, Northumbria for EIA work on their tidal energy device up in Shetland.

With the development of the new Marine Energy Test Centre in Orkney I am off to an academic workshop in Glasgow later this month. I hope to have some interesting points to share with you in the next FERG letter. I am hoping too, that I'll be able to impart some tangible knowledge with respect to my PhD research.

Sarah Dacre

Fluent News

Although it's been a very significant few months for me personally, there's not a lot to report on the project's progress.

The main progress has been the allocation of a new final year BEng student, Stuart Barnes, to work with us as part of his honours project. We hope to have him continue Jonathan Blyth's excellent work with Fluent by modelling several turbines in various formations to examine the wake effects downstream. I wish him all the best in getting to grips with that monstrosity of a program that is Fluent!

It was good to see Kostas again, on his flying visit in between conferences - he is currently pushing the limits of 3D-NS (our CFD code) much further, last update I had it was coping with five turbines - I suspect we're about to run out of computing puff!

On the "home front" I got married! On the 27th of July "up north", with no rain in sight - even a good

dose of sun for the afternoon reception! I have consequently moved out to Cove from the city centre and am beginning to understand the real meaning of the word "cold" when cycling in on a dreich (and being Aberdeen, ALWAYS windy!) morning!

We're still waiting for these experimental results from Strathclyde University - they seem to be unable to get a hold of either their laser-doppler measurement system OR the planned wave tank - there was even talk of the experiments being done in Malaysia!

My task for the coming weeks is to train Stuart in the use of Fluent (which will require a significant amount of head scratching and straining at my feeble memory) and also Jonathan Kerr who is to work on the Wind Farm project with Kostas using 3D-NS for his honours project.

AJ MacLeod

In-situ treatment systems for produced water clean-up

The aim of the project is to investigate the possibility of reducing the amount of hydrocarbons in produced water and hence the amount of hydrocarbons entering the environment using photocatalytic technologies.

To date, work has been carried out characterising different types of produced water using standard analytical techniques. Work has also been directed towards characterising different types of photochemical reactors using standard dyes. By using dyes, it is easy to compare the efficiency of each of the systems and hence make a selection of the best type of reactor.

Initial studies have been carried out using produced water in two potential reactor types. These results have shown that for certain produced waters, the 50% destruction time from the initial hydrocarbon concentration has been reduced from 90 minutes to approximately 9 minutes by optimising the reactor conditions. Over the next few months, the system will be further optimised and refined to cope with different types of produced water achieving similar destruction times.

Dr Ian Campbell & Prof Peter Robertson

To converge or not to converge

That is the question I am asking of Fluent lately. Whether 'tis nobler in the mind to suffer the slings and arrows of outrageous convergence criteria, or to

take arms against a sea of complex 3D geometries,
And by opposing solve them?

The models I am working on at present range from multiple inlet pipes and annuli, both 2D and 3D, with Newtonian and non-Newtonian single and two phase fluids, and using both the steady and unsteady state solver. As the title of this piece suggests, convergence is the monster I am struggling with at the moment, but prudent use of Fluent's autosave facility means that I'm not back to square one if a simulation crashes!

In a continued lyrical vein, I leave you with an ode to CFD (not penned by myself, but it's relevant none the less!)

Old codes never die;
They get handed down
to you and to I.

If yours does not have
Much robosity,
You need only add
More viscosity.

Many a knob and
Several a switch
Are required to run
It without a hitch.

If higher flop rates
You must realize,
Simply generate
A larger grid size.

If a trivial
Modification
Your manager seeks,
My estimation
Is at least ten weeks.
FERG Newsletter

Atholl Campbell

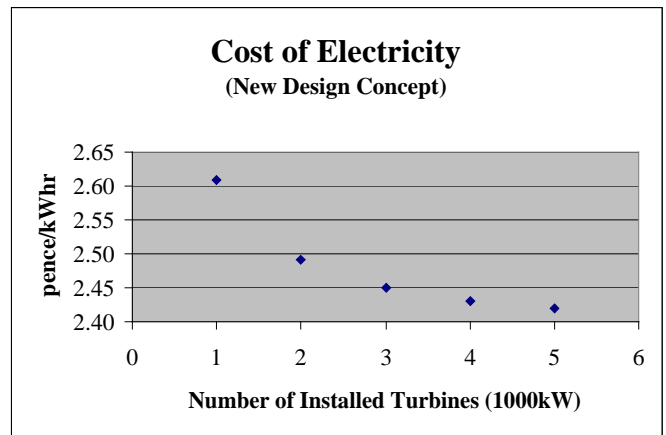
Tidal Propositions

It has been an eventful few weeks and months but not much of the activity has been related to research. My appointment as Associate Dean will inevitably change my working life in the future. It is too early to decide whether I will have more or less time to participate in research, however.

The new paper on the results of the OptCurrent project is almost complete. Actually it is complete

and I just need to tidy it up! I was invited to speak at the Orkney Science Festival on tidal current power, which was fun and gave me an opportunity to visit the islands again, which is always welcome.

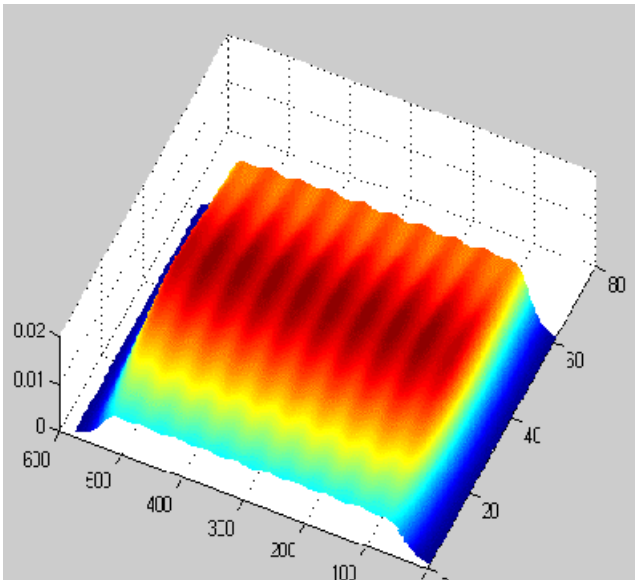
We managed to submit two new research grant applications. The first was to EPSRC to investigate the dynamics of tethered tidal current turbines. The second was to Scottish Enterprise as part of their "Proof of Concept" scheme and will, if successful, result in us actually building, installing and testing a half scale model of a new design of turbine which will slash costs.



If the predictions are correct the electricity generated will be at a cost below 2.5p/kWhr, which is directly competitive with fossil fuel. The tidal age may now be truly dawning.

Other tidal results are also intriguing. In collaboration with Angus and Kostas, I think I have developed a simple working model for the interactions of wakes behind tidal turbines, which can be used in the design of turbine farms. This is particularly important due to the influence that tidal turbines may have on geographic flow.

Many of you might have heard about plans to establish a tidal and wave research facility in Orkney. We have now been involved in the debate but are still outsiders in the discussions, which is their loss rather than ours.



Numerical simulation of the wake behind a tidal current farm

As a closing remark, Sarah is now progressing well towards the conclusion of phase one of the Pentland Firth project. She will report on this in more detail. I can, however, reveal that the predicted resource in the Firth exceeds 4GW using present technology and could exceed 16GW given appropriate technology. Quite a thought!

Ian Bryden

A few words from Steph

Over the past few months the mainstay of my activity has centred around the department in preparation for our new cohort of engineering students. I would also liked to have been announcing the start of the new course in Environmental Engineering - but since our validation didn't take place until long after most potential candidates had already secured their places at University - we finally decided to postpone start-up for one academic session to allow us time to "spread the word" about this fantastic new course!

The degree programme featured amongst the excellent material produced for the RGU stand at Offshore Europe 2001 earlier this month. In fact the diversity of activity within RGU was very much in evidence throughout the whole exhibition stand and its information packages - in support of our re-branding as "The Energy University". As will be

evident from the contributions in this and previous editions of the Bulletin, we have certainly risen to the challenge of sustainable development - in particular the impact of energy production and consumption, research and development of renewable energy sources and the impact of development activities on the environment.

My own project work is closely tied in with these areas - I'm interested, for example, in the technical and economic feasibility of fuel cell applications in transport and stationary power systems, as well as the environmental impact of any increase in their use. These types of projects should present some good opportunities for inter-faculty collaborative work - watch this space!

Of course, I am still closely involved with "environmental" development work at Wood Group. A key deliverable of my contract with them is certain aspects of their Environmental Management System and to this end I work alongside their new Environmental Adviser, Sam Long. It is of great interest to me to see how such management systems are implemented within the O&G industry and I am delighted with the opportunity afforded by the liaison between ourselves and Wood Group to see this first hand.

Stephanie Rigby

Wood Group Lecturer in Environmental Engineering

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