



Editor's Corner

Light at the End of the Tunnel?

Is it really the end of January already? The last newsletter was somewhat late. So now we're back to quarterly publication! The FERG organization has been a bit ad-hoc recently, with both myself and Kostas (particularly Kostas) working like time is going out of fashion. With luck, we can become more punctual for the next issue.

So much has happened since October. In fact so much that I can't even remember half of it! At the Christmas meeting, we had a very well received presentation by Joe Da Costa on his MSc thesis (see article). I think that if we had not had a second speaker (Prof. G. Georgantopoulos from the Aerodynamics Department of Hellenic Air Force Academy) and the room was only booked for two hours - we would still be discussing it now!

Prof. Georgantopoulos gave us an enlightening presentation on the test facilities at the academy. A very impressive array of wind tunnels. The professor is head of the renewable energy funding body of NATO and he and Kostas have discussed collaborative research between the Academy and RGU.

In the November meeting, we had a very interesting talk with the faculty librarian, Keith Fraser, on how the library can assist in our research needs.

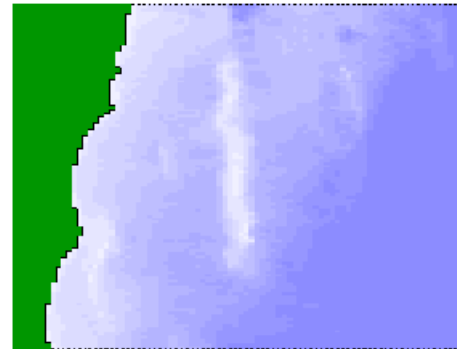
My partner in crime, Kostas, is leaving us for a sabbatical in warmer climes. He is off to Monterey (I'm sure there is a song in there somewhere?) to study atmospheric boundary layer modeling at the Naval Postgraduate School (see article). Good luck Kostas.

The offshoot of this is that the January meeting is now the AGM. Your chance to oust the autocracy fashioned by Kostas and me.

So how's my work going? No, don't run for cover just yet. Much of my time has been spent working with the Arklow Bank model. Although some optimization work had been carried out with data for this model, the data did not necessarily match the field data (now there's a surprise). During this process, Ian developed Tidesim 3D, which was incorporated into Visual Tidesim 3.1 (oooh). This development is substantially more stable than the 2.5D version and performs at larger time-steps. This has the key advantage of getting more runs/day.

RGU Tidal Simulation

00:00:00



The model-reality matching is complicated by a number of features. Firstly at this point in the St. George's Channel (between Ireland and Wales) there is a degenerate amphidrome. This is a virtual point on the land around which the tidal phases converged. According to the tide tables, there is between 2.5 and 3.5 hours phase difference between Wicklow, at the north end of the computational domain, and Courtown in the south. Secondly, the model works best when considering a channel, i.e. land boundaries either side of the computational domain. In the Arklow model, an open Von Neumann boundary has to be applied to the eastern boundary because the coast (Wales) is too far away to model. Thirdly, the Arklow Bank (where the field measurements were taken) tends to channel the water to either side.

These three features contribute to a situation where only one of the key flow variables (tidal amplitude, flow velocity and tidal phase) can be matched to the field data. If "tidal diamond" and tide table data are used for the boundaries at the north and south, then field data does not agree with the model data in any respect.

All this is rather unfortunate as I was hoping to present the Arklow Bank tidal turbine optimization in a paper at the ISOPE 2001 conference in Stavanger.

After much discussion with our Italian partners on the project, I have also started to model the Straits of Messina (between the "toe" of Italy and Sicily).

Due to the large change in depth and width (100m and 8km in the south to 250m and 4km at the straits) there is a large acceleration of the water through the channel. This makes the model quite unstable and a small time-step must be used. The two seas at either end have different densities, which causes stratification in the water column.

Also, historical field data suggests the presence of amphidrome in the straits. We are awaiting our own field data to confirm this. Fun and games!

RGU Tidal Simulation 00:00:00



In addition to the modeling work, I still have some work to do on the actual optimization package and (ooh!) my Ph.D.!

On a personal note, welcome back to Sarah, returning after extended leave due to illness.

Guy T Melville
Vice-convenor FERG



The Joy of FLUENT

The past few months have mainly been occupied by the completion of my RDR form, attending MSc lectures and an exam (which I'm pleased to say I passed!), and various literature reviews. I also ran a pre-exam Petroleum Geology tutorial for the members of the MSc Oil and Gas Engineering course. More recently, I have begun the CFD stage of my research which has initially been involved with the simulation of water through the inside of a realistically scaled drillpipe, at operating flow rates (i.e. around 450 gpm). This in itself has been (and continues to be) problematic as FLUENT does not take kindly to such high flow rates in small spaces, making convergence difficult to obtain. I struggle on for convergent solutions....

Atholl Campbell



School of Mechanical and Offshore Engineering now Officially the Tops in Research

Financial figures released for the 12 months up to the end of 2000 show that the SMOE is now clearly the best earning research department in RGU. The School's research income, not including TCS funding, came within a few pounds of £400,000. This is more than 50% of the total research income of the Faculty of Science and Technology and, indeed, more than 25% of that for the entire University. Not bad for a small School! Well done folks, keep up the good work.

Pentland Firth a GoGo

Although we failed to receive funding from the EPSRC for our proposed study of the potential of the Pentland Firth as a development site for tidal current power, the story does not end here. I believe that I have secured alternative industrial funding for the study and am currently re-writing the project as a 2 part study involving an initial £50,000 feasibility study, followed by a more substantial research and development component.

Given that the Pentland Firth could well be home to a £500,000,000 development by the end of the decade, I



believe that the early industrial interest will just be the start.

Top Job for Ian

Professor Ian Bryden, head of the School of Mechanical and Offshore Engineering has just been appointed Specialist Advisor to the Science and Technology sub-committee of the House of Commons. This post will cover the marine energy enquiry, which was announced on the nineteenth of January. Professor Bryden expressed delight at being selected for this strategically important position and being invited to participate, at the highest level, in advising parliament and government on future energy policy for the United Kingdom. "This is very exciting", he said. "It took only a week from being contacted by Westminster head hunters, to attending the House of Commons for interview by a panel of senior members of the house. This is national recognition of this University as a first class authority in energy technology and policy. Indeed, because the search for advisors was an international exercise and not restricted to UK citizens, the

recognition is truly international.”

Kostas Hits the Road

Dr Kostas Rados, lecturer in environmental engineering in the School of Mechanical and Offshore Engineering has been invited to undertake a 12 month study and research sabbatical at the internationally renowned United States Naval Postgraduate School. The Postgraduate School issues these sabbaticals to individuals, who are recognized for their international reputation, as a means of fostering long term links between overseas institutions and staff within these institutions. Professor Bryden, head of the School of Mechanical and Offshore Engineering commented that “Once again the international status of the staff of the School is being recognized. The University should be very proud of this and Kostas should be congratulated for this accolade”

Ian Bryden



FERG Discovers Linux Man

It seems like an age since the last update, and quite a lot has been done. The biggest change has been the additional help of a final year BEng student, Jonathan Blyth, whose hard work has saved me endless hours of unpleasant experiences with Fluent (the commercial CFD package we're using).

Having Jonathan fight Fluent has left me the pleasure of using our (vastly better!) in-house CFD package, 3D-NS, to produce results with which we can compare the two CFD programs. Although rather arcane in use (at the moment), it has produced good results on other problems and is more predictable than Fluent whilst also being infinitely more flexible.

Another major change has been the arrival of two new computers. Our budget had been set to cover the cost of a decent Sun Unix workstation necessary for the project. However, with the rapid advances in free Unix clones and the release of a Linux version of Fluent, it was decided that a top spec PC using Linux as an operating system would be a more cost effective solution and one was built to our specification by Grampian Electronics.

This has proved a massive success, providing performance comfortably superior to our current Sun machines for a fraction of the cost, and also interacts transparently with the current Sun network. Indeed, so much money was saved that there was enough left over for a very good laptop which is also capable of running CFD cases and has both Windows and Linux installed. This allows both

Kostas and I to take work home and will no doubt be travelling with Kostas to the States next month.

The arrival of these computers has enabled me to vacate my previous haunt of the Sun Room and take up residence next door in the rather less tropical atmosphere of C517. Being of Northern descent, I've found this quite a bit more comfortable than the "Sun Lounge"!

Work in progress: the time has come to compare the results generated by Fluent with those from 3D-NS. Even if they are close, the results of experiments being carried out by our partners should be available soon....

AJ MacLeod



Presentation at last FERG meeting of 2000.

My presentation to the group regarded my MSc Thesis, which some of the staff with ‘longer teeth’ liken to Homer’s epic poem. Like the latter it contains the elements of fire and water. It concerned the examination of a 90/10 Cupro Nickel deluge fire suppression system subjected to worst-case hydrocarbon gas fire conditions as might be encountered in an offshore compartment fire. Two scenarios were principally examined.

In Scenario One, I was concerned with the perspective on the formation of a steam plug (colloquially known as Steam Choke) in the deluge pipework - the potential blockage stopping the water being delivered to all the nozzles, thus the effectiveness of the system in mitigating the fire would be reduced. The potential for this kind of situation might occur if the water deluge did not extinguish the fire.

Here, I used a *flowing water* case based on Industry practice, coupled with an ideal heat transfer approach from the fire environment to determine whether the deluge water reached saturation conditions i.e. boiled. The results happily indicated that it was unlikely.

Subsequently in Scenario 2, I used a *non flowing case*, as might be found when the fire is burning but the deluge water is not flowing. Due to the lack of previous work this examination to be proved the more challenging. I realized that to determine failure points of material/components that I would initially need to determine the build up rate of the deluge pipe metal temperature. I derived this by transfer technology alias pinching from the structural steel Industry. Subsequently I derived Temperature-Time curves for each of the pipe metal sections of varying diameter.

The results indicated that the build up rate of the pipe metal temperature followed the build up rate of the fire; this statement is of some concern because compartment hydrocarbon fires develop very rapidly i.e. ceiling temperatures of 1200°C can develop in a handful of minutes. Of course, one should remember here where the system is located? - yes, you guessed it, the ceiling!

The second case scenario findings raise concerns about the performance standards that Industry use in their presented Safety Case for the survivability of this equipment under such conditions.

The question remains to find the perspective of this new information in light of the Industrial situation. This thought is supported by a current HSE report which calls for future work in this specific related area.

One of my principal conclusions regards a need to revisit this area with more sophisticated analysis tools, hence there is a potential for further research for RGU in this area.

This potential is currently being pursued.

I very much enjoyed presenting my work to the group; it was a fitting and personal culmination to my Odyssey!

'Don Jose'

Finis Coronat Opus



Adaptive Intelligent Control

"My present design, then, is not to teach the method which each ought to follow for the right conduct of his reason, but solely to describe the way in which I have endeavored to conduct my own." (Rene Descartes, 1596-1650)

Research in this area is slowly picking up pace, some good results and outcomes of design have been generated in the area of **Ground Testing for Aircraft, Flexible Structures and Remotely Operated Vehicles**. Results for Ground Testing have been produced and published for AIAA Annual Meeting - Jan 2001. Results for the Flexible Structure has been produced for IFAC European Conference - Sep 2001 and ROV results have been sent to ISOPE - September 2001.

Fuzzy Logic Control has been the key tool in these three different projects. Fuzzy Logic Control provides a formal methodology for representing, manipulating, and implementing a human's heuristic knowledge about how to control a system. Fuzzy Logic is not only for Controls, it

could also be used for modeling and pattern-recognition to name few other applications. A Fuzzy system is a static nonlinear mapping between the its inputs and outputs. Inputs and outputs of the system belong to "crisp" -- that is, they are real numbers, and an interface is used for both input and output to convert data between crisp and fuzzy world. Information mapped by fuzzification is used by inference mechanism in parallel with fuzzy rules, in the rule-base, to produce fuzzy conclusions, and the defuzzification block converts these fuzzy conclusions into crisp outputs.

If you are interested in learning more about Fuzzy Logic, there are lots of texts available on this topic. Though if your interest is in Fuzzy Logic Control Systems, refer to Technical Report on Fuzzy Logic Control (SMOETR 200101C, Feb 2001).

Asher



Research Pays

The current status of research in the SMOE.....January 2001.

EU Funded:

- Opt-current - tidal current electricity.....750,000 ECU
Ian Bryden
- Efficient development of offshore wind-farms.....697,902 ECU
Kostas Rados
- Removing toxic compounds from water.....1,200,000 ECU
Peter Robertson

EPSRC Funded:

- Optimization of tidal farms£116,916
Kostas Rados
- Polymer composites subject to fire£50,000
Reza Looyeh
- Engineering Network£62,000
Douglas Morrison

Teaching Company :

- Wilkie Engineering..... £90,000
Reza/Christopher
- Briggs Marine £65,000
Ian / Brian
- Prestaroy£90,000

- Steve / Euan
- IMES£85,000
Sha / John

Proof of Concept : Scottish Enterprise

- Peter Robertson.....£ ?
- Edward Gobina.....£ ?
- EPSRC Doctoral Training Grant£14,500

There are in handCurrent Applications - Current Recruitment - Current Strategy - and there soon will be.....The School of Engineering .

NB. It has been noted that the above sums of money are not all unique to RGU accounts [partnerships with other institutions and directed expenditure are not shown].

However, we may claim to be ‘research active’ in the SMOE.
Douglas Morrison



Gone with the wind

The convenor is off! I will be away for a year sabbatical leave to join the research team at the Department of Meteorology at the Naval Postgraduate School in California. The department has one of the leading meteorology programs in the US that offers both Master of Science and Doctor of Philosophy degrees. The department currently has more than 20 faculty members and covers broad research areas in atmospheric dynamics, boundary layer processes, mid-latitude synoptic analysis, atmospheric remote sensing, tropical meteorology, etc. It also has several theme laboratories and a well equipped computing lab for numerical simulations of the atmospheric processes as well as observational data analysis.

During the visit, I will join the faculty and staff at the Marine Boundary Layer Laboratory of the Meteorology Department and conduct co-operative scientific research on the evaluation of surface flux and boundary layer parameterizations in a meso-scale atmosphere model, focusing on the high-wind conditions.

Expected outcomes and targets are:

- To enhance the existing expertise in the School of Mechanical and Offshore Engineering of RGU in the Environmental Engineering research field by conducting high quality research on atmospheric flows

using advanced numerical tools for atmospheric boundary layer simulation.

- To set up and establish the framework for collaborative research between the two institutions in the prospect of attracting external research grants by conducting joint research proposals in the future.
- To enrich and reinforce the current course structure of the BEng(Hons) and BSc(Eng) Mechanical Engineering, PgD/MSc Offshore Engineering programmes as well as the new BSc(Hons) Environmental Engineering programme by introducing new, attractive, advanced and up-to-date topics/modules on atmospheric modeling methods and techniques.
- To set up the basis for possible student exchange between the two institutions.
- To publish at least two papers in scientific journals of high impact factor for future RAE exercises.

I take this opportunity to express my warmest thanks to Prof. Ian Bryden and Prof. Francis McIntosh for their support of this sabbatical leave. From my part, I promise to do my best to meet these targets.

I will miss you all FERGies ...

Kostas Rados
Convenor



Meet the Professor

Thanks to Guy’s persistence and threats of making me a “legitimate target” I have finally put fingers to keyboard for the FERG newsletter. For those of you who don’t know my history prior to joining SMOE I worked as a lecturer in applied sciences specifically in the areas of environmental protection and technology. Prior to that I worked as a government scientist in NI again working in environmental protection and monitoring. Before that I was a post doc in the Irish Republic investigating environmental applications of electrochemical technology. In effect for the past 11 years I have been working in some form or other on environmental research or protection.

Now as Chair of Energy and Environmental Engineering I am moving onto new challenges. My main objective is the establishment of a sustainable Centre for Environmental Engineering through the development of applied research projects and environmental courses. My main research interests focus on photocatalytic processes. This rather glorious title simply means I use light to clean air, water or generate power. Since taking up the post I have already

been successful with two grant applications in this area. The first is in collaboration with my good friend Linda Lawton from Applied Science and is on developing a photocatalytic reactor to remove toxins from drinking water. This 1.2 M Euro project is in collaboration with two German partners, The Institute for Solar Energy Research in Hannover and ecoTRANSfair in Braunschweig, and The Hebrew University of Jerusalem. I have also received funding for removal of hydrocarbons from water generated by the offshore oil and gas industry. My other research interests are on the development of liquid junction photovoltaic cells. These are much simpler than their solid state counterparts and are potentially cheaper to produce. They are however prone to "photocorrosion" which is what I am work on preventing.

In addition to photocatalytic technology I also have been working on electrochemical processes. One project funded under the DTI/NERC Seasense programme is on the development of heavy metal sensors for in situ monitoring in the marine environment. This work has been carried out in collaboration with Danny McStay and Pat Pollard of the Optoelectronics Research Centre. I also have a project on optical heavy metal sensors in collaboration with Marcel Jaspars from Aberdeen University. Another area of electrochemical technology I have investigated is recovery of heavy metals from waste waters using specialised electrochemical recovery cells. Why the interest in heavy metals? Well, the sum of heavy metal pollution is greater than all the organic chemical, radioactive and infectious wastes put together. Plus they accumulate rather than biodegrade.

This is just a small snapshot of some of the things I am working on. As you can see I am very much in favour of collaborative work with other disciplines. Such environmental research invariably requires this type of multidisciplinary approach. I am also always on the look out for new partners and opportunities so if you have anything you want to discuss come and see me.

Peter Robertson



Reza's Projects and Papers

It's nearly 6 months since we have started a TCS programme with Wilkie Engineering on the development of alignment tools for offshore industry. Everything goes well so far according to the original plan. Christopher as the TCA has already made his impact on the company's business specially by improving the manufacturing process and reducing the total cost of 3T(M) as one of the main

mechanical alignment tools. He has also made progress in the conceptual design of bolthole spreader and nut splitter tools. The other aspects of the project such as development of advanced technical library and solid modelling using ProE have already been touched. Christopher is going to give a talk on his findings during the FERG meeting in March. I have also made arrangement for student visit to the company in February.

Since the allocation of the capital bid for the purchase of a thermal/mechanical/dynamic spectrometer in late November, I have been in negotiation with different companies within UK and Europe to get the best possible package. The order is now on the way to a company in Germany and I am hoping to receive the equipment by the end of March.

My latest paper entitled "Modelling the response of reinforced plastic joins to fire", sent to the first MIT conference on computation fluid and solid mechanics, has been accepted for presentation in MIT in June 2001. An extended version of this paper will also be published in an international journal.

Hopefully more news to come on the start of my EPSRC project!

Reza Looyeh



Back at Last!

Hi there Everyone!!

HAPPY NEW YEAR to you all!!! :0)

As most of you know I am back and in working order after one of lifes medical anomalies! It was tough having three months off! I promised my self I would make good use of the time. Alas! Things just didn't seem to work out that way after all.....sorry Ian! Before my sudden disappearance I had plans to attend Marine Science 2000 at the Dunstaffnage Marine Lab., Oban, MAREC 2001 in Newcastle and the ECOSUD conference in Alicante, Spain. However, this was and is not to be.

I am now back, but as yet not quite into the full swing of things.....but give me time. I am off to sunnier climes in a few weeks and hope to get myself going by that time and then after.....

Well, I am joining Ian Bryden at the "Creating an all-energy future" conference here in Aberdeen at the end of

February, which I am sure will be very successful. At the moment my plans are not that much different from the last Ferg Newsletter, but I will enlighten you again anyway. I am hoping to complete my objective 1 of my PhD project by the beginning of February. The conceptual diagram illustrating the environmental impacts of tidal stream energy has initially been completed (other issues may emerge in time), but more work needs to be done on the development of the Environmental Impact Index. The aim of which is to provide a tool for identifying the environmental constituents most at risk in a semi-quantitative way. Work is soon to start on the modelling aspect of my project and hopefully shortly a model showing the flow disruption in a channel due to tidal current devices will be achieved. I am optimistic that this will bring forth other 'key' issues regarding any impacts surrounding tidal current energy. I am currently working on other modelling stages of the project, trying to put together mathematical relationships regarding the conceptual model.

"Read lots, Write lots!" I have made a start of writing my thesis.....I know its generally early, but by putting thoughts down on paper I can see better the issues that lie ahead and see more clearly the questions that are being asked. I am hoping this will also save me from the mad panic at the end! I am also in the process of writing a short overview of my PhD for a journal paper. Other papers are also in the pipeline with respect to the modelling phase of the project.

I have enjoyed being here at RGU very much so far and I thank you all for being an instrument in that enjoyment - both academically and socially! :0) Thank you for being such stars!!!

Anyway, guess I should go.....

Sarah Dacre



Forthcoming Events

We've finally got our act together and got a timetable of presentations for the coming meetings February to June 2001. The meetings will stop over the summer (July, August) and commence again in September. The presentation plan is as follows:

February	Peter
March	Chris
April	Said
May	Atholl
June	Babs

The meetings are held on the last Friday each month from 2pm.



Publication Date:

The next bulletin will be due in April. The editor will be decided at the March meeting.



Artist's impression of maintaining a twin rotor tidal turbine.

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