P4820 Mathematical Physics III
Real World Experience

P4820 can seem a little abstract from physics so I like to find people in the community who actually use these techniques. Interestingly enough, even though we all benefit from the results of these powerful mathematical tools, it's suprising how few people actually realise how they work.

Fraser Davidson: Fraser.Davidson@dfo-mpo.gc.ca

Fraser Davidson is a research scientist who works in the Science Branch of DFO. Fraser has developed an ocean forecasting system for the Newfoundland coastal area. That's a bit like a weather forecast for the ocean and in fact, Environment Canada is starting to use output from Fraser's models to help with weather prediction (ocean temperatures are very important to weather). Modelling ocean circulation requires solving the Navier-Stokes equation on geophysical scales.

Nadine Veillette: nveillette@ageophysics.com

Nadine Veillette is a geophysicist with Abitibi Geophysics. This company do the classic kind of electrical resistivity (and chargeability) and electromagnetic surveys that one uses when trying to find metal ore deposits.

Stephen Green: sgreen@provair.com

Provincial Aerospace is so much more than scheduled flights to Lab City. Stephen Green is the Director of Research and Development for Provincial Aerospace. The company has been very active in developing radar applications deployed from small aircraft and they are interested in developing iceberg tracking and prediction capabilities.

Renat Yulmetov: renat.yuletov@c-core.ca

C-Core is a research organisation affiliated with Memorial. Renat is working to take iceberg drift prediction to the next level; three subproblems appear: 1. Improving dynamics-based models, which comes down to rewriting the equations of motion and their numerical integration. 2. Applying machine learning, which is in fact non-linear optimization with tricks. 3. Trying to clean bad input data by applying Tikhonov's regularization (L2 optimization again) the project involved discrete element/lattice methods. The particular problem was bridging continuous and discontinuous behaviours of material.

Yujian Huang: yujian.huang@c-core.ca

C-Core is a research organisation affiliated with Memorial. Yujian Huang works in the areas of: Time Domain High Pressure Zone (HPZ) Modeling, ceberg Load Analysis, Offshore Structure Downtime Modeling (Iceberg), Discrete Element Modeling (Sea Ice), Ice Management Modeling (Sea Ice), Added Mass for Icebreakers during Ramming, Ship Ram and Transit Data Analysis.

Sebastien Donnet: Sebastien.Donnet@amec.com

Works with Department of Fisheries and Oceans studying current flow in coastal bays. He has a background in ocean modelling and ocean physics.

Jeremy Dillon: jdillon@krakenrobotics.com

Kraken robotics works autonomous underwater vehicles and as a part of that work has developed novel acoustic applications. Jeremy Dillon is responsible for the acoustic signal processing and navigation (tracking) of underwater vehicles. I've always viewed Jeremy as a bit of a magician with digital filters but his math skills go way beyond that restricted domain.

Ayiaz Kaderali: Ayiaz.Kaderali@huskyenergy.com

Ayiaz Kaderali works with Husky Energy with a focus on seismic surveying for oil and gas. Seismic studies invert signal recorded when acoustic pulses bounce off of multiple sedimentary layers in the earth surface.

What I would like you to do is arrange to meet with these people and ask them how mathematical techniques are used in their work. I suggest contacting them through email and please send me a cc of the email so that I know what's going on. Some questions you could ask include: what techniques do they use, do they have to try different techniques on the same problem, do the techniques fail some times and if so, what causes difficulties. It might also be interesting to ask a bit about their education and how they got into their present position.

I would like you all to write a 500 word summary of the meeting. Also, each of you will be asked to give a 10 minute presentation to the class describing your visit with this person. That way we can all share in the experience!

I've assigned students to interviewees randomly but you are welcome to trade between yourselves if you have special interests, just let me know what's going on.

The presentation will be on **Monday March 25** and the summaries are due on that date as well.