Collaborative Code Development with CIG

AuScope Simulation & Modelling Victoria – Monash University and VPAC

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AuScope (www.auscope.org.au) is an Australian organization formed to facilitate the implementation of a world-class infrastructure system for earth science with a significant component of modeling software development. A fruitful and positive collaboration on software development has been built up between the Melbourne-based geodynamics software group in AuScope and CIG.

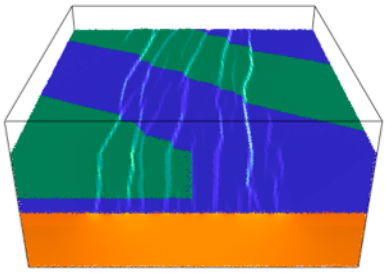

Figure 1: Underworld/Gale model of shear deformation in a layered viscoplastic numerical experiment.

We have held a number of developer-meets-user retreats in Australia with strong participation from members of the CIG team and the research community. At these retreats we have been able to solve outstanding issues raised by users, start seed projects, develop and trial new algorithm prototypes, discuss new developments in the field, and highlight risk areas for our projects. Both the *Gale* and MaDDS projects were initiated by retreats held close to Melbourne. Our developers and collaborators have also benefitted considerably from attending and contributing to CIG meetings.

In developing new software with CIG, we have consolidated Underworld as a framework for long-term geophysics, and StGermain as an environment for facilitating reusable numerical software. In turn CIG has contributed by driving features such as free surface deformation, PIC in irregular meshes, frictional boundary conditions, and solver configurations targeted to Gale problems.

The StGermain model for scientific code development is targeted at collaborative software development. Each component or feature is developed and maintained in isolation, contributed to a toolbox or plugin, and stitched into a “code” by means of an input file. In general, as new features become available, one doesn’t need to change their own code to use it. About two years ago the Gale developers forked Gale from the Underworld repositories, and in doing so isolated its users from the continually evolving features in our toolboxes and the framework itself. Some features that are readily beneficial include multigrid, refined PIC, REP, and so on. We believe the collaboration would strengthen if the CIG long term geodynamics community were to adopt a policy to keep their code coherent with the Underworld release set.

The value our group then represents, is the research and implementation of numerical components that make the solve times for such systems tangible, on various computer architectures, as been demonstrated to date.

Our vision is to provide the International long term geodynamics community a platform for rapid and robust application development. There are three key challenges to scale our infrastructures to what the community might ask for in a “dream application.”

One challenge for anyone implementing software infrastructure for these problems is, and will continue to be, the ability to describe complicated multi-scale, multi-physics systems and solve them efficiently, while simultaneously making such infrastructure available to novices, as well as to the math- and C-literate power users.

A second challenge is to enabling flexible model development: our group is developing features such as template PDE equations to readily describe large coupled systems, configurable block based solvers, and compile-time stitching.

Creating a high quality software product for a diverse user-base and set of expectations is/will be a challenge for infrastructure providers such as CIG and our group. We are developing infrastructure to support users using auto-generated GUIs in conjunction with the Australian Grid programme. We’re also beginning to develop binaries that encompass all the dependencies, and continue making the traditional tar-ball frequent releases, and repository access. This infrastructure will leverage code- and meta-information already in the developed toolboxes, and will produce an environment for cost-effective development and maintenance of a spectrum of “codes.” Also, a new suite of unit, scientific, and system tests are in development.