# Using GPGPU Hardware for Design Optimization Models

The Design Innovation and Computational Engineering Laboratory (The DICE Lab) is searching for talented computer science students to assist our research efforts. One of our key pieces of software is a combined modeling and optimization tool that was written by a series of graduate students. This code has been forked several times and several incompatible versions now exist. Code performance is also suboptimal in several respects, with 1- to 2-orders of magnitude performance improvements considered possible (without GPGPU incorporation). As such, we are looking for students who can improve this software.

The software in question is designed to model large datasets using spline mathematics (Non-Uniform Rational B-splines), however various researchers have added specific components. The code is written in older-style C++ (C with classes and templates). We seek to:

- Improve speed and reduce memory usage.
- Link the code to commercial software packages such as MatLab and Mathematica.
- Incorporate several forks of the software into a master version.
- Improve code readability and modularity.
- Compliance with the newest C++ standard.
- Produce a redistributable package to limit the necessity of distributing source code.
- Implement a simple GUI to replace the current text-based UI.

- Improve algorithm performance wherever possible.
- Incorporate GPGPU computing and parallelization principles to enhance performance.
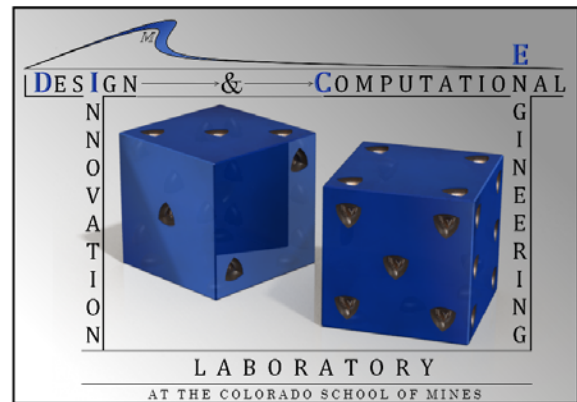
We recognize that this is a task requiring time and expertise. As such, we have NSF funding to support one or more students after the field session project during the summer. Compensation will be at NSF approved rates. In addition to summer support, this project offers opportunities to:

- Work with cutting-edge scientific software.
- Work with the campus' most powerful GPGPU workstation (>5 TFlops).
- Develop work experience highly relavent to a future industry position or graduate education.
- Contribute to research publications.
- Work in an environment that respects your talents! We are not looking for someone to just write code. We are looking for students who can fundamentally improve a piece of scientific software, and will consider any ideas or suggestions for improving, restructuring, or modifying the software in question.

If you are interested in this position, please contact: Dr. Cameron Turner by email at cturner@mines.edu, or in person in Brown Building W370E.