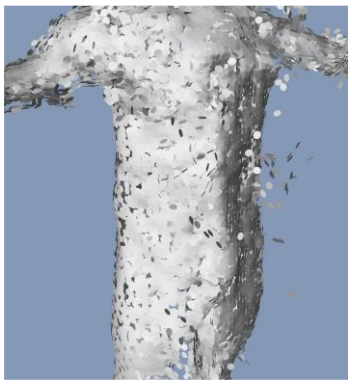
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

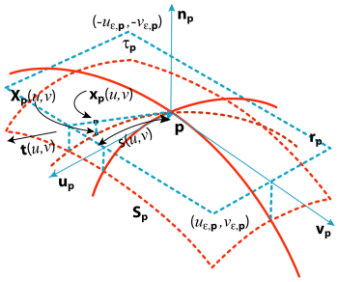
Summer Scholarship Scheme 2010/2011 Application Form

Title of Project: Point-set surface rendering

Project Leaders/Supervisors: Igor Rychkov

Brief outline of project:





When a surface is given by a point cloud it is natural to visualise it first using the points as a display primitive. There are several approaches to the point-based rendering. Accounting for local illumination we could display point as simple "sprites" or more sophisticated "surfels" and "splats" where the point carries some differential information, such as the normal, from the surface it implicitly defines along with its neighbouring points. Once we engage in some local surface modelling we can also benefit from self-projecting and remove the noise points, for instance. Furthermore, a local approximation to the surface enables the global illumination by ray tracing because the actual ray-surface intersection point is to be found from the local polynomial.

A key challenge of these point-sets is that they are rather large yet require very fast rendering. Fortunately, we have just acquired high-capacity GPU cards allowing one to put multi-million point sets to the GPU memory and render from there using appropriate OpenGL shaders and doing as much computation as possible on GPU.

The project aims at looking at different point rendering techniques on GPU, firstly for local illumination. We then proceed by working with point-set surface geometry to implement some more advanced local and global illumination methods.

Benefits student will gain from involvement in the project:

1) **A good practical introduction to point-set surfaces and differential geometry of surfaces.**
2) **Using programming skills on the real world, mathematically-loaded problem in computer graphics**
3) **Learning to program mathematics on GPU**
4) **Working on the next generation GPU cards**

Academic level of student sought:

1) **Proficiency in Differential Geometry of Curves and Surfaces**
2) **Experience in C/C++/Python and OpenGL programming.**

Has this project also been submitted to the university scheme? No