**EE271 Winter 2017 Project Report**

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**Project Results**

Total Dynamic Power (mW): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Total Leakage Power (mW): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Total Power (mW): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Total Area (mm2): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Total Performance (triangles/second): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Number of Rasterization Units: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Actual Clock Used (ns): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Design Optimizations:**

1. Backface culling

2. Multi-sample testing

3. Reduced multiplication precision

Clearly and briefly address the following for each optimization (NO MORE THAN ONE page per optimization)

* Before implementing the optimization, how did you evaluate the efficacy of the optimization? How did you estimate cost and performance?
* How did you implement the optimization? Was there anything particularly difficult that you were not expecting?
* What were the actual changes in cost and performance?
  + How/Why did this deviate from your estimation?
* You are encouraged to include effective and clear figures or plots to help comment on any of the above.
* It’s helpful to include tables or plots to compare the change of the throughout, the number of rasterization units needed, the clock period, the total power, and the total area for each of your optimizations.

Is there any analysis/discussion that you did for the project that you would like to share (no more than a page)?

Please provide any concluding thoughts on the project and share anything you think that can improve the design.

Optimization 1: Backface culling

* Before implementing the optimization, our guess for overall performance improvement was for the throughput of the unit to approximately double, and for all other parameters to stay relatively constant per unit. This is because only a small amount of hardware is added to implement the backface cull, while about half of all samples should be culled. Bubble smashing should prevent culled polys from slowing throughput.
* Implementing the optimization was fairly simple, just adding the logic for culling in parallel with the bounding box calculation.
* Actual changes from the optimization can be found in the table below.

Performance changes (Using vec\_271\_02\_sv.dat):

|  |  |  |  |
| --- | --- | --- | --- |
|  | Before optimization | After optimization | Change (%) |
| Cycles / uPoly | 26.94 | 14.26 | -47.1% |
| Clock period (ns) | 0.5 | 0.5 | 0% |
| Throughput (uPoly/ns) | 0.0742 | 0.1403 | +89.1% |
| # Rasterization units | 7 | 4 | -42.9% |
| Power per unit (mW) | 61.88 | 87.29 | +41.1% |
| Area per unit (um^2) | 35795 | 46747 | +30.6% |
| Total power (mW) | 433.2 | 349.16 | -19.4% |
| Total area (mm^2) | 0.2506 | .1870 | -25.4% |

Optimization 2: Multi-sampling

|  |  |  |  |
| --- | --- | --- | --- |
|  | Before optimization | After optimization | Change (%) |
| Cycles / uPoly | 14.26 | 5.220 | -63.4% |
| Clock period (ns) | 0.5 | 0.70 | +40% |
| Throughput (uPoly/ns) | 0.1403 | 0.274 | +95.3% |
| # Rasterization units | 4 | 2 | -50% |
| Power per unit (mW) | 87.29 | 164.06 | +87.9% |
| Area per unit (um^2) | 46747 | 110965 | +137.4% |
| Total power (mW) | 349.16 | 328.12 | -6.0% |
| Total area (mm^2) | .1870 | .222 | +18.7% |

Optimization 3: Reduced precision multiplication