Sampling and Anti-Aliasing

- Frequency vs. Space review
- Sampling Filters
- Integrating methods
- Supersampling
  - Adaptive
  - Jittered
  - Distributed

Frequency vs. Space review

- Neat dualities between Frequency and Spatial domains
  - Convolution <=> Multiplication
  - Finite <=> Infinite
  - Impulse <=> Sine function
  - Boxfunction <=> Sinc function
- Sharp edges require infinite extents
  - Cutting off (Windowing) outer range produces wiggles
  - Remember square wave example
  - Sharpness with ringing, or blur without

Sampling Filters

- Generally finite non-zero extent
- Sampling with filters
  - Position filter at sample point
  - Multiply image function by filter
  - Integrate result for sample value
- How to integrate?
  - Easy for constant (box) function
  - Build summing table for seperable functions
  - 2d summing table for non-seperable functions
  - Tables require rectangular areas

Integrating sampling methods

- Subpixel polygon algorithms (Crow, Catmull, Duff, Abrams et al)
  - Weighted vs. unweighted areas
  - Pixel areas should overlap (complicated)
- Beam tracing (Heckbertt and Hanrahan)
  - Uses notoriously difficult cookie-cutter algorithm
- Cone tracing (Amanatides)
  - Painful cone reflection calculations
  - Hierarchical cones suggested
- Highlights?

Supersampling

- Trace more rays, use higher resolution
  - Expensive
- Adaptive supersampling
  - Trace more rays where needed
- At pixel level
  - Weight with filter function
  - Distribute with filter function
- At image level
  - More samples needed in detailed areas, how?

Adaptive Sampling

- Look at local variance in coarse array of samples
- Take more samples in areas of high variance
- Coarser arrays risk missing small things
- Nonuniform samples require more thought for reconstruction
  - Fit surface to samples to resample for display

Jittered Sampling

- Aliasing vs. Noise
- Film emulsion
- What kind of jitter?

References

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