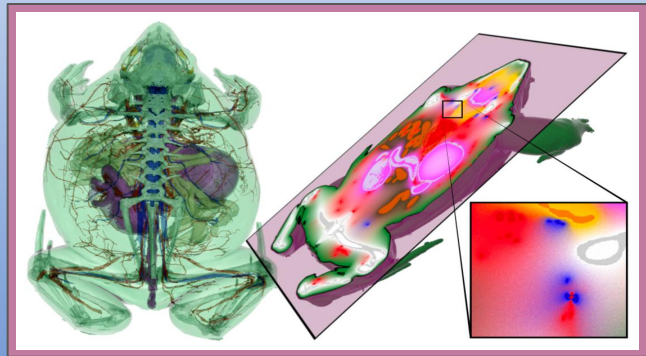# Monte Carlo Geometry Processing
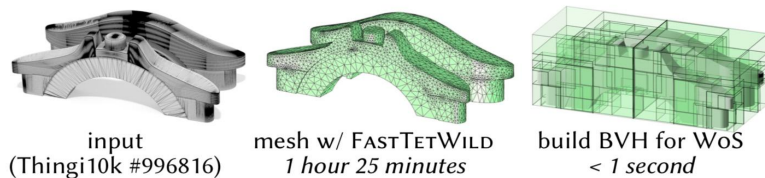
Presented by Mitchell Dodson
Based on *Monte Carlo Geometry Processing: A Grid-Free approach to PDE-Based Methods on Volumetric Domains*
Sawhney, 2020

- Replaces Monte Carlo ray tracing of "finite-element" meshes with a method for approximating values within an arbitrary volume.

- Breaks up the input volume into a *Boundary Volume Hierarchy*, which enables you to look for regional solutions on-demand instead of finding a general solution.

- Performs a *Recursive Sphere Walk* from a starting location within the volume, which approximates the interior solution of the volume at that point (similar to density).

- Uses importance sampling to choose random walk starting positions that will quickly converge on a harmonic function approximating the relevant part of the volume.

- This method has many important applications in rendering, mathematical modeling, denoising, and systems design.

Local solution using frog CT scan as input

Boundary Volume Hierarchy generation from volume

input
(Thingi10k #996816)

mesh w/ FASTTETWILD
1 hour 25 minutes

build BVH for WoS
< 1 second

Harmonic Volume Solutions

input (X)   curl-free (∇u)

div-free (∇ × A)   harmonic (Y)
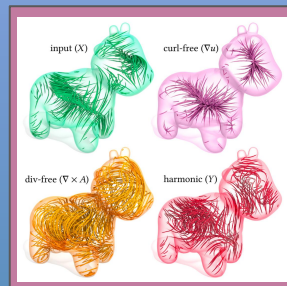
Recursive Monte Carlo Sphere Walk