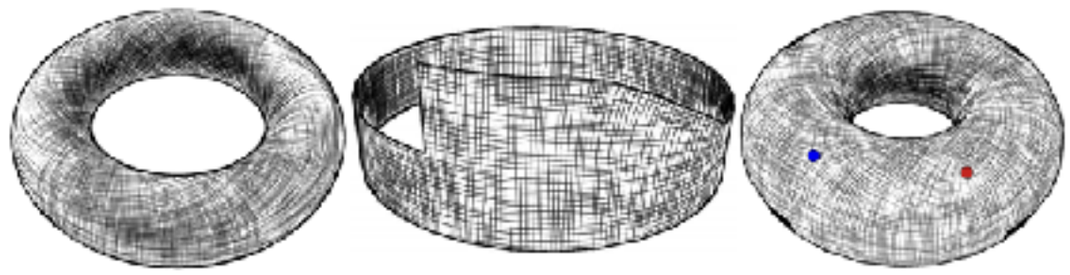

OPEN QUESTIONS

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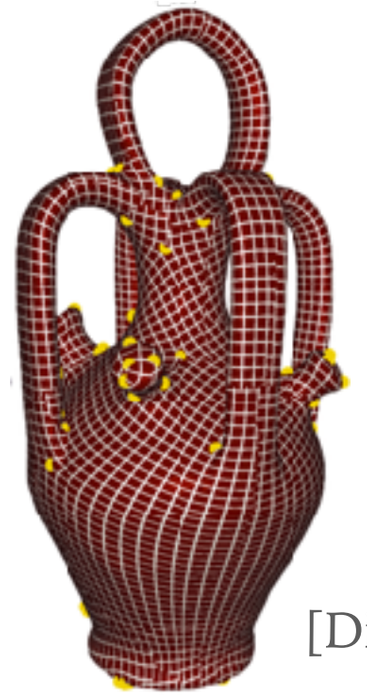
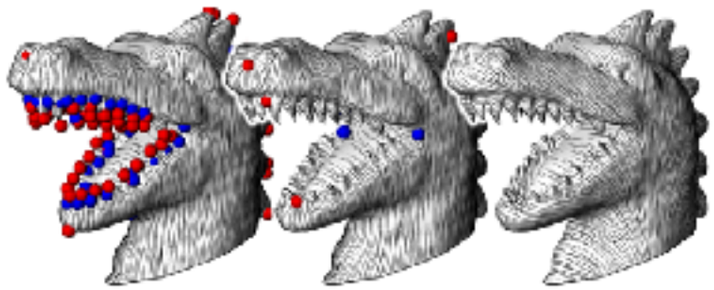
OPEN QUESTIONS: TOPOLOGY CONTROL

- Implicit Methods
  - Unpredictable singularities
    - Usually many low-degree.
  - Vector fields
- Explicit Methods
  - Specifying singularities
  - Direction fields
  - …but nonconvex
- Current attempts: alternatives to as-parallel-as-possible.



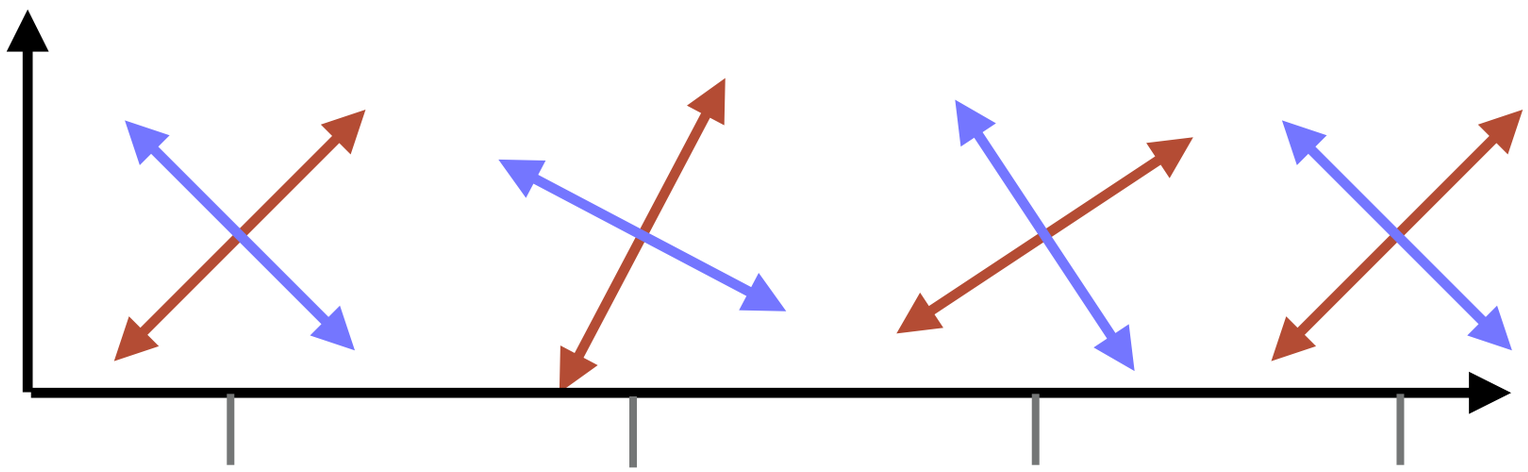
[Diamanti *et al.* 2015]



[Ray *et al.* 2009]

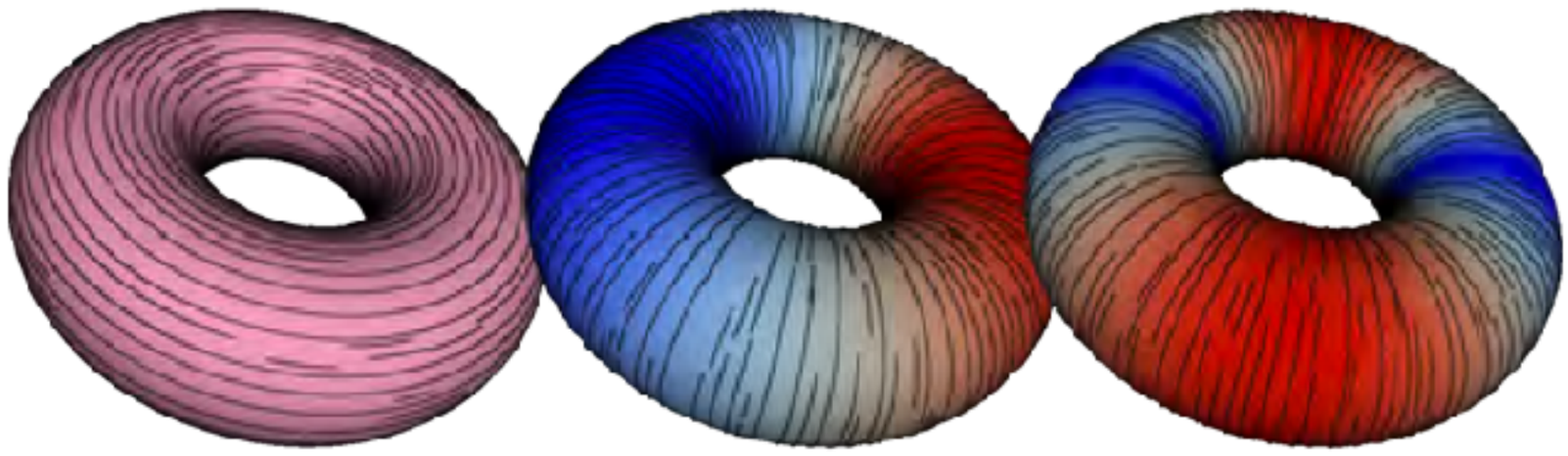
OPEN QUESTIONS: SAMPLING & CONVERGENCE

- Discrete animals: matching, period jumps.
- Bridge the gap between the continuous and the discrete.
- What is a good sampling?



OPEN QUESTIONS: GEOMETRY

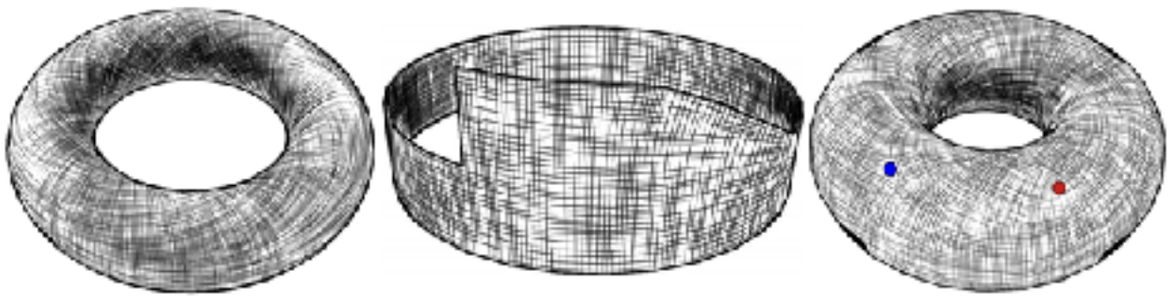
- Lie Bracket
  - [Azencot *et al.* 2013, de Goes *et al.* 2014, Azencot *et al.* 15].
  - Local and directly on vector fields
- Differential geometry of directional fields
- Calculus
- Operators



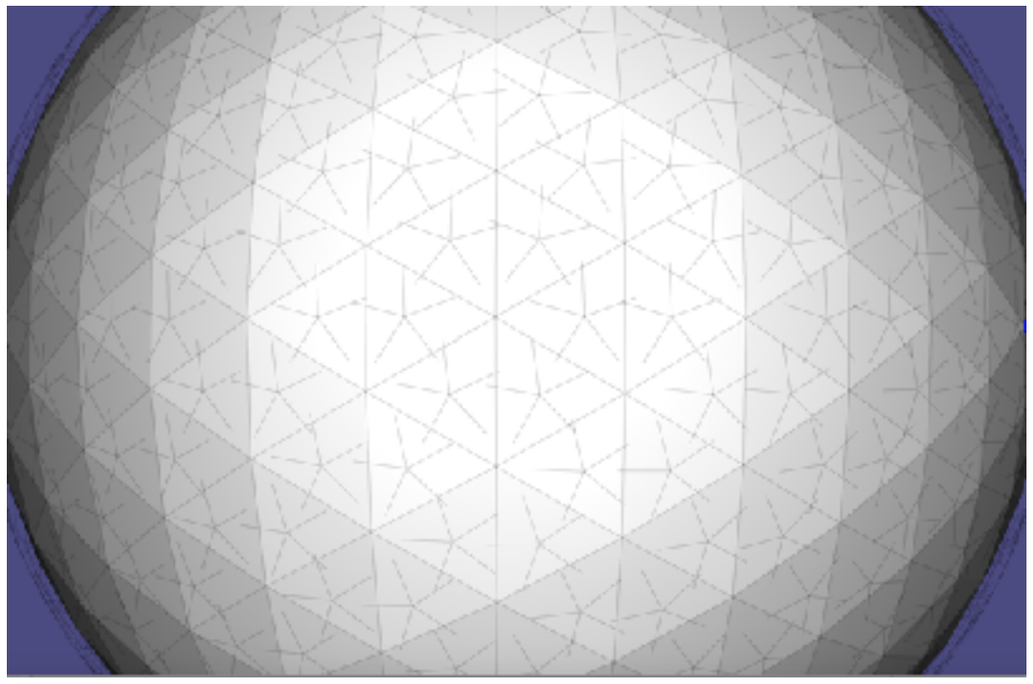
[de Goes *et al.* 2014]

OPEN QUESTIONS: PARAMETRIZATION

- Branched functions are more restricted than directionals.
  - Param -> vectors: always possible.
  - Vectors -> Params: *generally* impossible.
    - [Kälberer *et al.* 2007, Izmestiev *et al.* 2012, Myles *et al.* 2014]
- What is the space of parametrizing directionals?

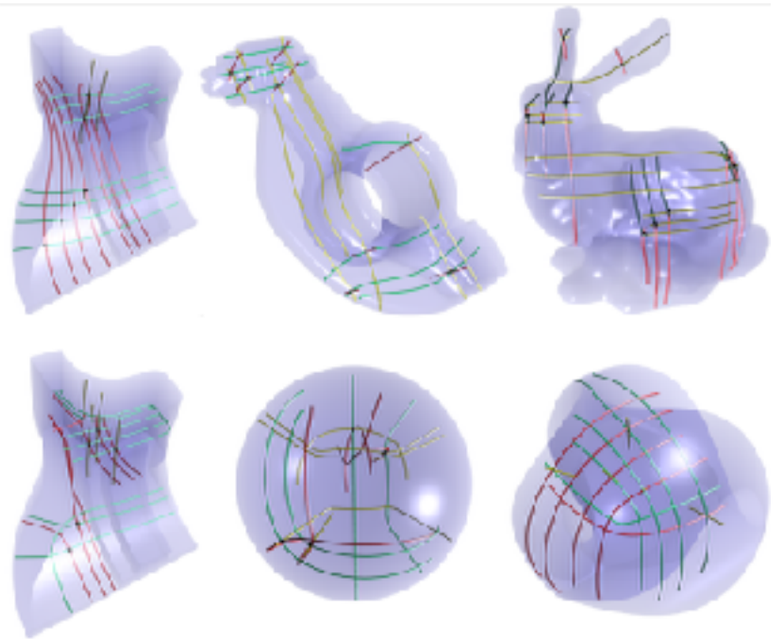


[Myles *et al.* 2014]

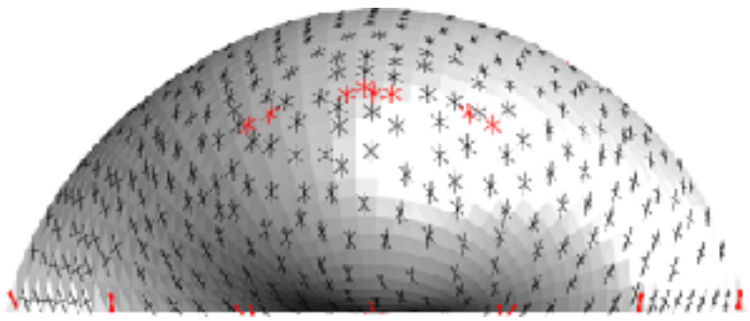


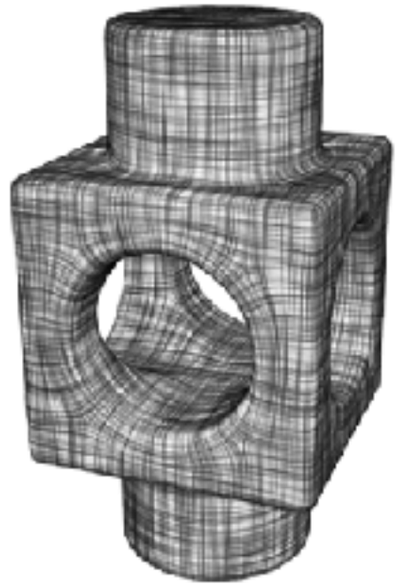
OPEN QUESTIONS: THREE DIMENSIONS

- Generalization is difficult:
  - Rotations are not commutative.
  - No notion of angle-based representation.
- Singularities: curves and nodes.
  - Index theorem?
- Current attempts:
  - Quaternions [Kowalski *et al.* 2014]
  - Tensors [Paris *et al.* 08]
  - Spherical Harmonics [Huang *et al.* 2011, Ray *et al. 2016* Solomon *et al. 2016*]



[Huang *et al.* 2011]

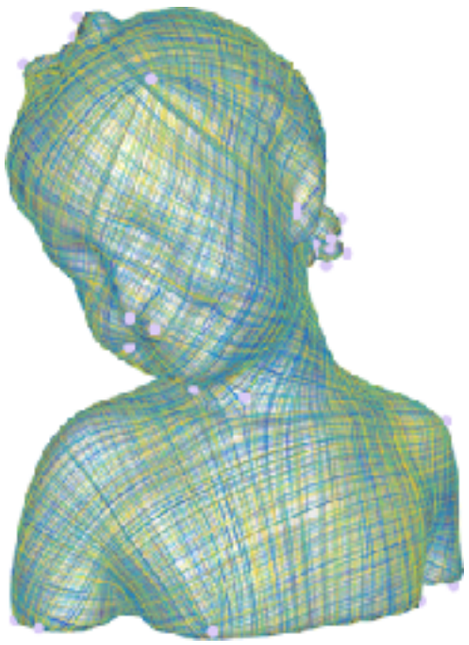




Symmetry

Anti-symmetry

THANK YOU!



**Course repository: https://github.com/avaxman/DirectionalFieldSynthesis*