Scientific Computing Sampler

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Cornell CS Scientific Computing Group
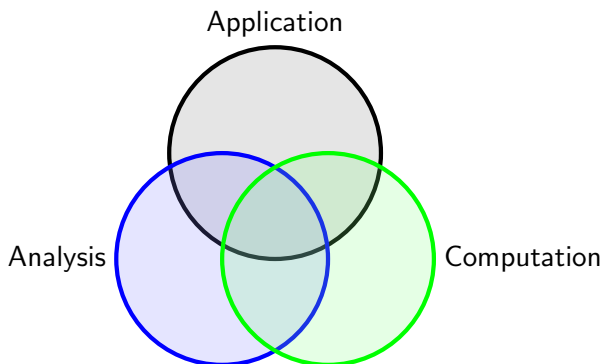

Austin Benson

David Bindel

Anil Damle

Charlie Van Loan

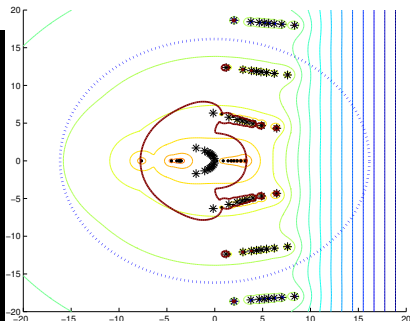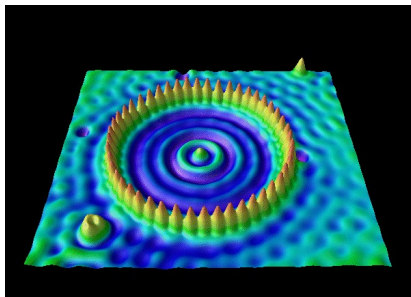# The Computational Science & Engineering Picture

- MEMS
- Smart grids
- Networks
- Systems

- Linear algebra
- Approximation theory
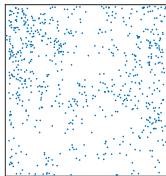- Symmetry + structure
- Optimization

- HPC / cloud
- Simulators
- Solvers
- Frameworks
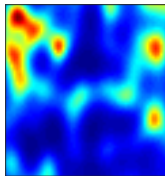
Resonance and Nonlinear Eigenvalue Problems (NEPs)

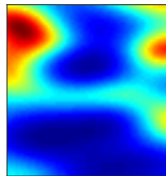$$T(\lambda)v = 0, \quad T : \mathbb{C} \to \mathbb{C}^{N \times N}$$

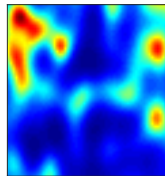# Scalable Kernel-Based Approximation and Optimization
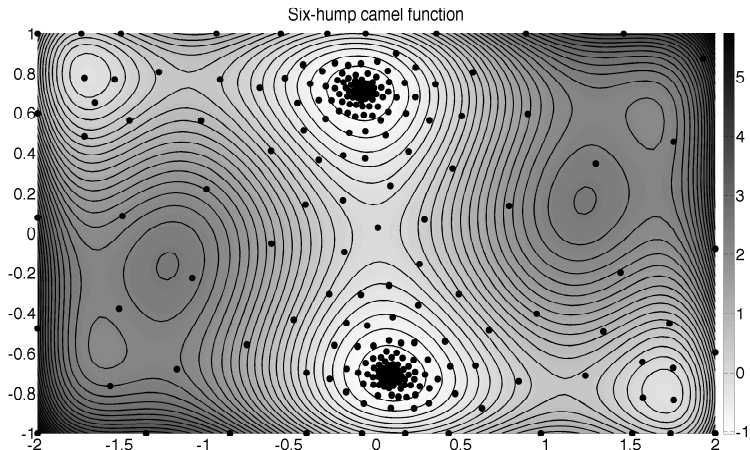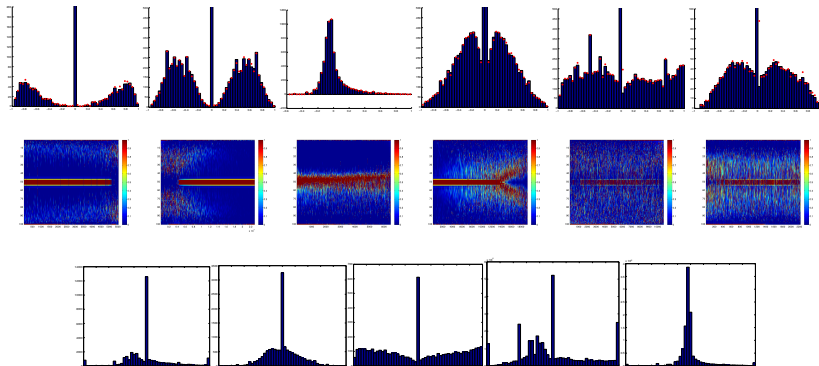

(a) Point data   (b) Exact   (c) Old approx   (d) New approx

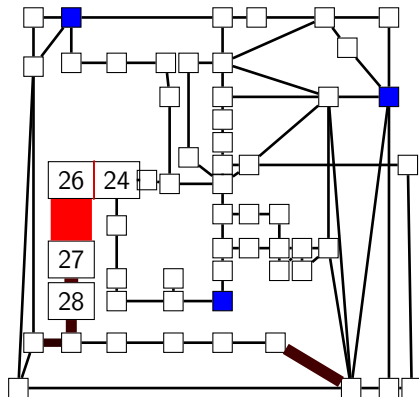$$\mathcal{L}(\theta|y) = -\frac{1}{2}\left(y^T K(\theta)^{-1} y + \log \det K(\theta) + n\log(2\pi)\right)$$

Asynchronous Parallel Global Optimization

Six-hump camel function

Graph Densities of States

Finding Contingencies in Power Grids

And many others...

DB: femur.vtk

To-be-Updated Vertices Dependent Vertices Unrelated Vertices

Block Boundary

(a) Vertex-Oriented Computation (b) Block-Oriented Computation