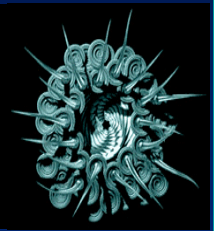
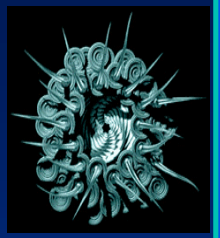


III- 2D, 3D, and Statistical Models

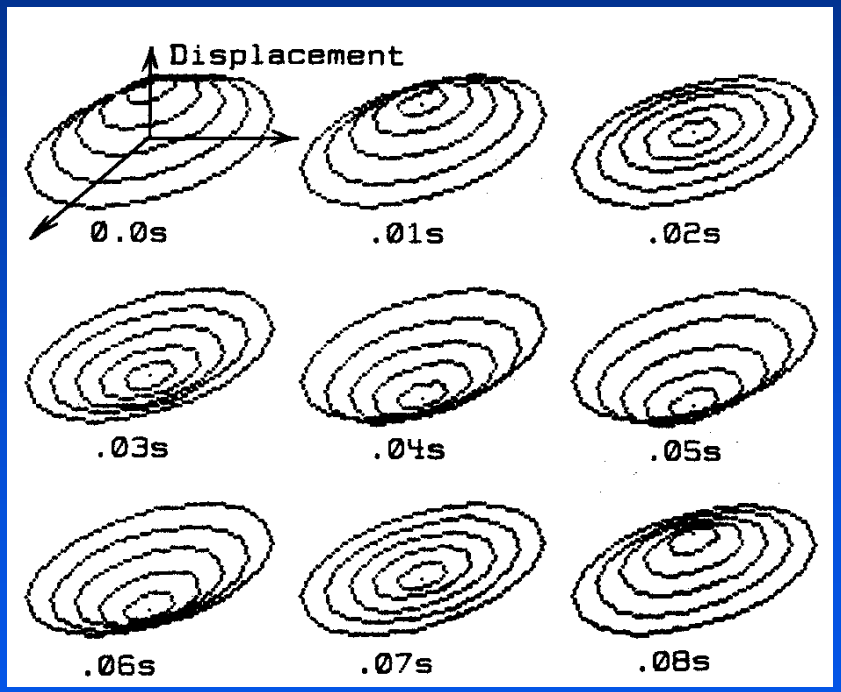
Perry R. Cook

Princeton Computer Science
(also Music)

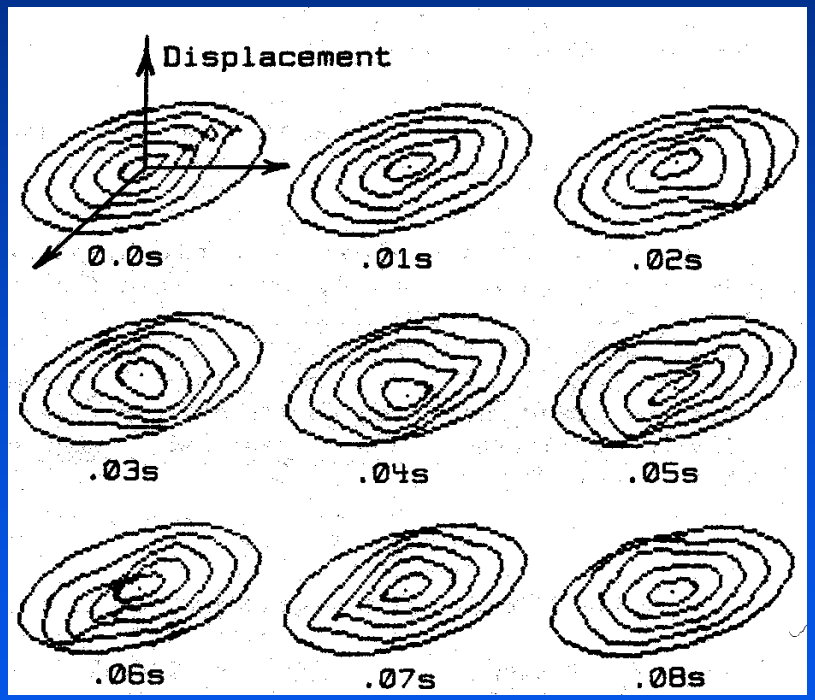
Modal Synthesis: Plates, Drums



Modes of Plates: inharmonic (round = Bessel)

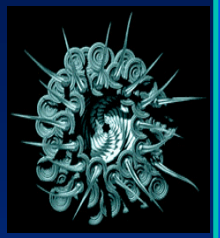


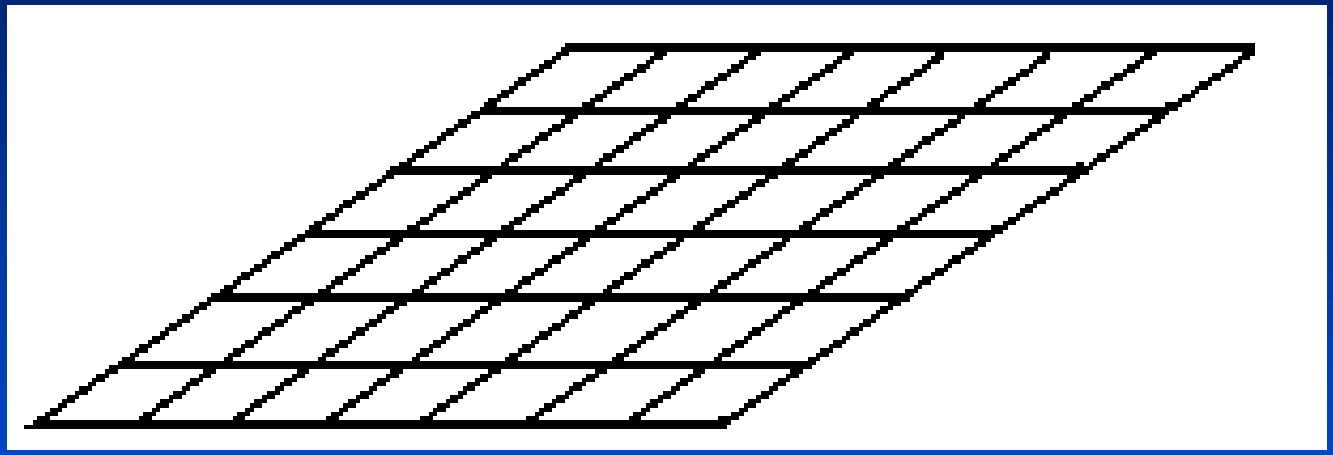
Center strike



Edge strike

Physical Models: 2D surfaces

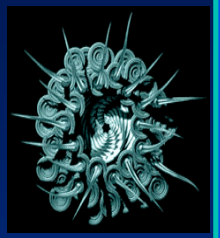




2 (N) Dimensional Waveguide Meshes or Finite Elements and Finite Differences

- *Discretize objects into cells (elements)*
- *Express interactions between them*
- *Express differential equation for system*
- *Solve by discrete steps in space and time*

Two and Higher Dimensions



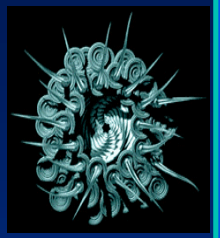
2 (N) Dimensional Waveguide Meshes

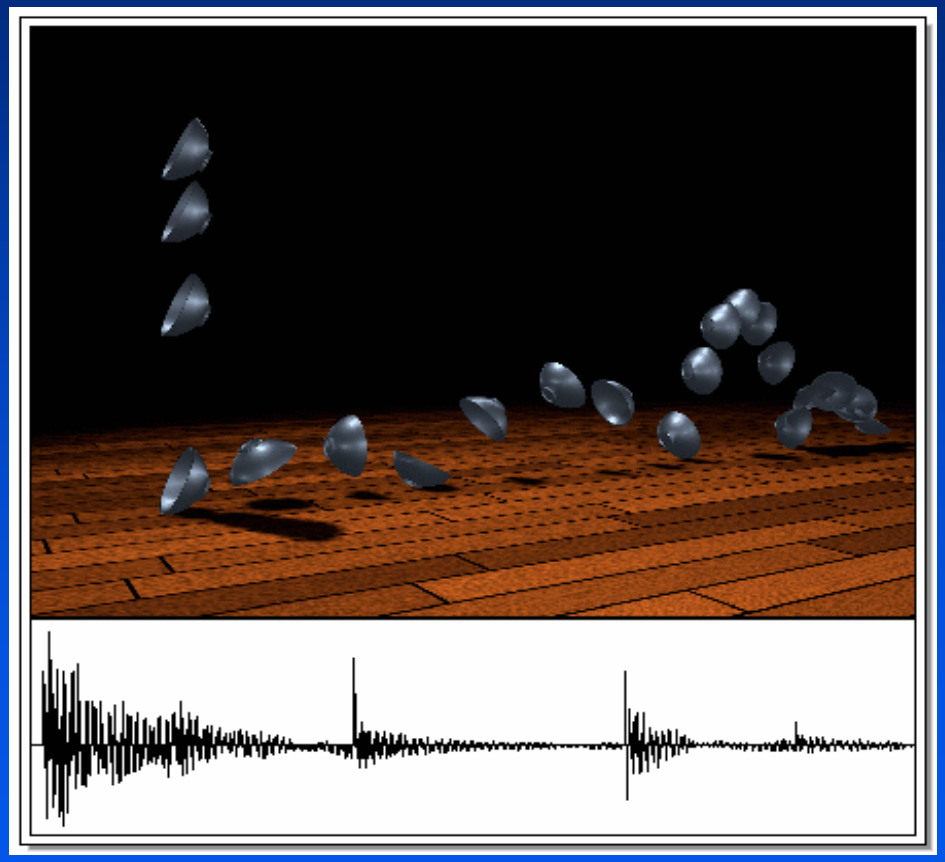
or Finite Elements and Finite Differences

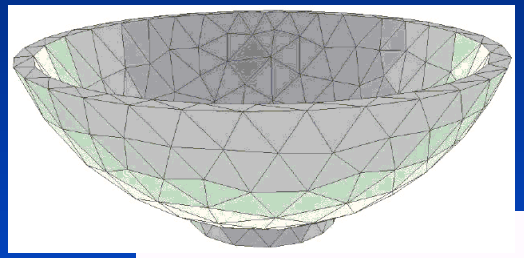
- *Discretize objects into cells (elements)*
- *Express interactions between them*
- *Express differential equation for system*
- *Solve by discrete steps in space and time*

or Modal Solution

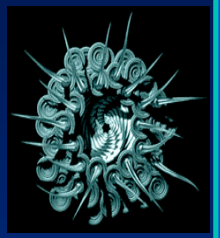
Finite Elements (with O'Brien and Essl)



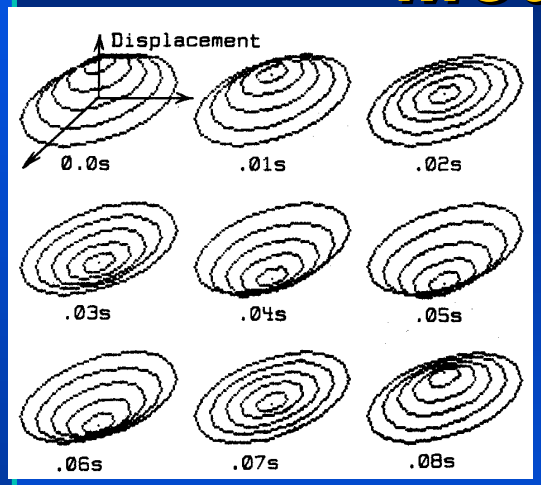


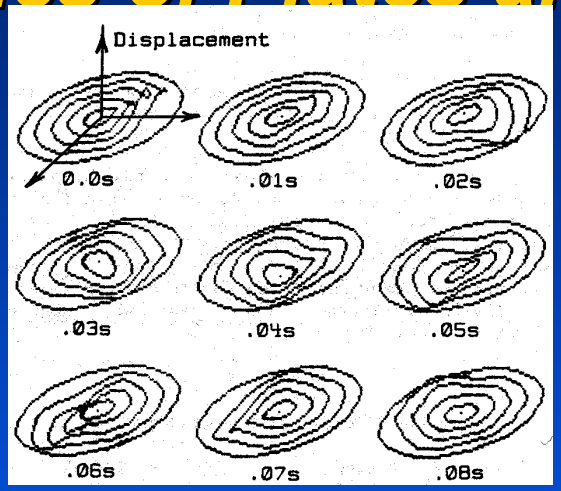


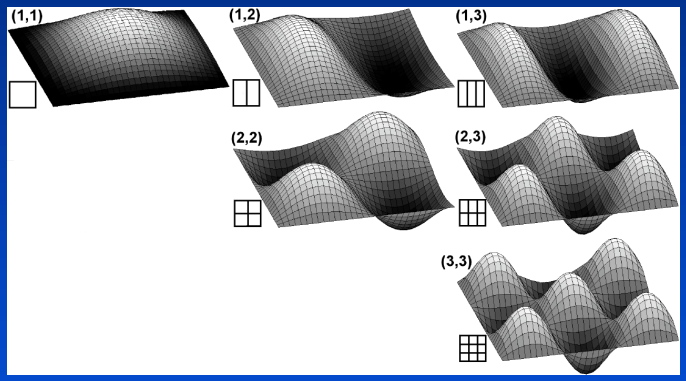
Hi-D Modal Solutions



Modes of Plates are inharmonic





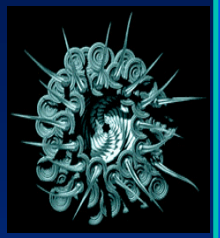


Center strike **Edge strike** **Square Plate Modes**

round = Bessel function roots **= sqrt(I) factors**

Modes in higher dimensions are problematic
(impossible analytically except in very simple cases)

2D Meshes, Finite Elements and Differences



Strengths

- (somewhat) arbitrary geometries
- Less assumptions than parametric forms
- Can strike, damp, rub, introduce non-linearities at arbitrary points

Weaknesses:

- Expensive
- Don’t know all the physics/solutions
- Sampling in space/time
- Dispersion is strange (diagonals vs. not)