Microfabricated Scanning Endoscope

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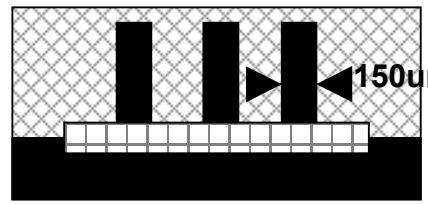
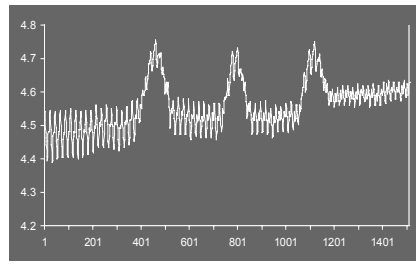
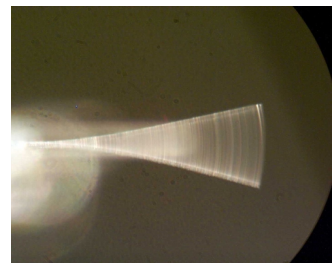
Goals and Potential Impact if Successful

The goal of this research is to develop an inexpensive micro fabricated integrated optical scanning endoscope/display system:
High frequency > 20 kHz sVGA
Large field of view (>90°)
Color
Small (<1mm diameter enclosure)

The small size will enable users to examine areas anatomically inaccessible by currently designed endoscopes and enable integration of imaging with other functional devices such as therapy and diagnostic devices.







Approach and/or Accomplishments

Modeling:
Use of nonlinear dynamics to understand the behavior of the scanning wave guide. Whirling, harmonics and bifurcations.

Use of finite element modeling to increase reliability.

Experimental work:
Construction of prototypes have shown feasibility. So far: Epoxy resin based cantilever waveguide scanner, 30° field of view, greater than 5kHz, stable scan.

Bottlenecks and Open Research Questions

Optics - Light coupling efficiency, diffraction limit, micro lenses, optical properties.
Material Data - Mechanical and optical loss factors, fatigue life, etc.
Integration and Packaging - Complexity in fabricating integrated systems. Durability and compatibility in a clinical setting
Control - Closed loop control may be necessary for large displacements of scanner. Endoscope manipulation to reach hard to reach areas.