An Integrated Aerial Image Sensor
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Motivation

- Aerial Image Sensor

2005 Main Objectives

- Complete design of transducer capable of nm-scale aerial image resolution (year I milestone: 1,27,2004 – 1,26,2005)
- Integrate prototype transducer for use and deployment on a silicon wafer (year II milestone: 1,27,2005 – 1,26,2006)

Integrated Aerial Image Sensor (IAIS) Concept

IAIS Concept (1D):
\[ T_n = t(\xi, w, W_n, W) \prod_{m \neq n} c(\xi / W) \]
\[ t = \frac{1}{2} \sin \left( \frac{\xi}{w} \right) \cdot \text{rect} \left( \frac{\xi}{W} - 0.5 \right) \]
\[ W_n = (n - 1) \cdot P + w \]
\[ W_n = m \cdot P + (P - w_n + \Delta) \]

- Detector representation:
\[ g_n(x) = S(\xi, \omega) \cdot T_n(\xi, w, \Delta, n, m) \]
\[ I_n(x) = F[J_n(\xi, \omega)] \]
- Detector Image Contrast (DIC): at max & min position

IAIS Design - Near Field Simulation*

- Illumination phase shift 180° and 0°
- Max & min intensity vs. aperture thickness and width
- Aperture mask thickness in the range of 70nm & aperture mask width in the range of 30nm

Other Parameters

- Aperture mask transmittance in the range of 70nm & aperture contrast drop 0.2%, peak transmission drop 38.5%

Summary for Aperture Mask Design for 130nm Period AI (65nm node)

- Aperture groups phase "moving" at max & min position

Bench-Top Testing Experiment

- Imaging field of View

IAIS Processing Proposal

- Mask aperture patterning:
- Integrated structure assembly:

Future Goals

- Integrate prototype transducer for use and development on a wafer (year II milestone: 1,27,2005 – 1,26,2006)
- Package the technology for inclusion into the zero-footprint metrology prototype (year III milestone: 1,27,2006 – 1,26,2007)

Acknowledgment