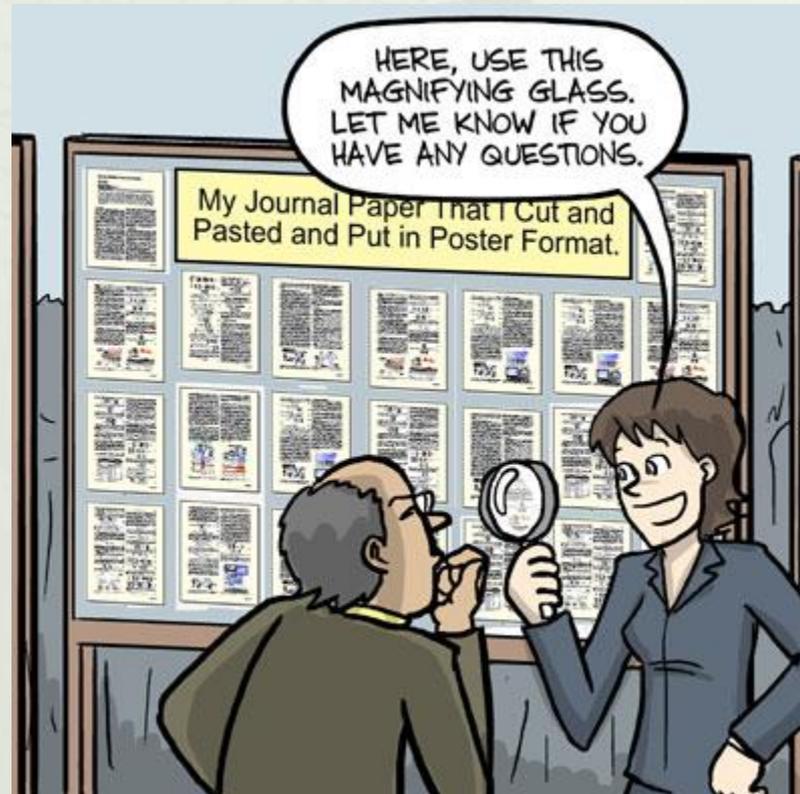




ENSC 405W Poster Presentations

© Steve Whitmore & Mike Sjoerdsma

July 2018





Presentation Outline

- Types of Oral Presentations
- Logistics:
 - ❖ New Options
 - ❖ Time for Design & Execution
 - ❖ Set-up & Evaluation Details
- Poster Considerations:
 - ❖ Organization
 - ❖ Layout
 - ❖ Colour
 - ❖ Pixelation and Alignment
- Audience Considerations:
 - ❖ Questions
 - ❖ Learning Styles
- Questions & References



Logistics I

- Poster presentations will take place in ASB Atrium South on **Thurs, Aug 02 from 08:30-11:30**. Confidential presentations in ASB 9898.
- **Required:** All team members must attend.
- **New Technology:** Use a laptop connected to a large monitor on which to display your poster (**NOT** on the laptop monitor!).
- ❖ **Advantages:** Inexpensive, multimedia potential, the future direction.
- ❖ **Disadvantages:** Requires a large (23-24"+) monitor (I have a spare monitor of that size I can loan). Reserve a monitor from AV or bring a widescreen TV from home. Do this ASAP. Bigger is better here.
- ❖ **Alternatively:** Use a tri-fold board.
- ❖ **Warning:** We do not want a PowerPoint Presentation; we want a single slide on a large screen. You explain the rest of the material.
- ❖ **Proof-of-Concept device is required to demo functionality.** Not pretty, but demonstrates the concept works.



Logistics II

- Start early! You will need to **double your time estimates.**
- Bring your **Engineering Journals** to the poster presentations. I pick them up at the end of the day. They are returned in ENSC 440.
- E-mail me a **.pdf of the poster** by 11:59 PM that evening.





Logistics III

- You require an **interactive element** (model, demo, computer presentation, etc.).
- **Bring your own monitor, powerbar, etc.**
- Everyone should know and be able to defend the content (I suggest everyone practice being able to **explain the poster and demo in 1-2 minutes**).
- **Steve, Andrew, and the TA** will visit each poster for 15-20 minutes; other folks may wander in at random.
- **Poster grades** are the average of your rubric scores, so read over the rubric closely. Note that we discuss (and correct) the grades following the presentations.



Typical Poster Sections

➤ **Heading:**

- ❖ **Descriptive Title:** *Airplane III: Drone-Based Drug Delivery*
- ❖ **Names of Authors:** Ted Striker & Johnny Jacobs
- ❖ **Name and Logo:** Drop-in Medical Inc. 
- ❖ **Contact:** E-mail address, website (if you have one)
- ❖ **Affiliation:** Simon Fraser University, Engineering Capstone Project
- ❖ **Date:** 02 Aug 2018

➤ **Objective/Purpose/Problem Statement**

➤ **Background Information**

➤ **Research/Results**

➤ **Proposed Solution/Future Work**

➤ **Conclusion**

➤ **Abbreviated References**



The Layout

Intuitive Layout

Improving Automobile Ride Quality:

Actuator and Controller Design for Active Noise Control

Nakul Verma, Matthew Ward, Ash Parameswaran, and Mike Sjoerdsma

Objective

- Improve ride quality for occupants
- Implement active noise and vibration control

Disturbances

- Road roughness
- Engine vibration

Sound and Vibration

- Sound and vibration are pressure waves in matter

Constructive Interference

Destructive Interference

Research Direction

- Active noise and vibration cancellation
- Generate anti-phase signal for actuators
- Controller design and actuator research

Controller

- Controller facilitates sensor and actuator testing
- Sound algorithm development applied to vibration
- Filtered-X LMS adaptive strategy (in development)

Actuators

- Linear actuators added to vehicle suspension
- Active engine mounts
- Use off-the-shelf components where possible
- Build actuators if required

Electromagnetic actuators being considered

Active Door Panels

- Damp out car door vibrations

- Hard base material with embedded actuators
- Investigations into magnetostriction (Terfenol-D)

Future Work

- Vibration setup with shaker table
- Transition controller algorithm to vibration setup
- Working door panel with matching power amplifiers

Less Intuitive Layout

Class D Audio Amplification:

The Power Electronics Solution

Nakul Verma, Ash M. Parameswaran

Traditional Audio Amplification

- Linear amplification: Output = Gain x (Input)
- Multi-stage linear analog system
- Amplifier energy dissipation controlled by input
- Transistor or vacuum tube based

Disadvantages:

- Efficiency vs. fidelity trade-off
- High component count
- High operating temperature
- Large and heavy

1

Class D Audio Amplification

- Analog/digital audio to PWM conversion
- PWM drives H-bridge power stage

Advantages:

- Highly efficient
- Small size
- Minimal operating temperature
- Relatively low component count
- Digital audio device seamless integration

Manufacturers:

- Philips Semiconductor
- Bang & Olufsen
- Texas Instruments

Power Electronics

- Power conversion: AC-DC, DC-DC, AC-AC
- Electromagnetic actuator control:
 - AC/DC motors
 - Solenoids
- Actuator minimum threshold voltage
- Pulse Width Modulation (PWM): time encoded pulses
- PWM pulses drive "H-bridge" amplifier
- H-bridge amplifier:
 - Dual opposing switch pairs
 - Bi-directional current routing
 - Switches fully on or fully off

1

Current Class D Audio Applications

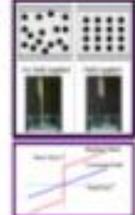
- PWM essentially digital
- Audio to PWM conversion via signal processing
- Eliminates A/D converter chips:
 - Reduces audio signal distortion
 - Lowest cost
 - Lowest system power consumption
- Low power devices last longer
- High power systems run cooler
- Audiophile digital audio amplifiers
- Personal/portable electronics:
 - Personal Digital Assistant (PDA)
 - Cell phones
 - MP3 players
 - Hearing aids
- Car subwoofer amplifiers



Colour



Auto 21 Reducing Structure Borne Noise: The Development of a Semi-active Bushing
 Michael Sjoerdsma, Nakul Verma, and Arsh Passarwan
 Project F03-FIN, Simon Fraser University

<p>PURPOSE</p> <p>Car manufacturers are reducing the mass of automobiles in order to increase the fuel economy of their vehicles. Although this reduction of mass has positive benefits, it also makes newer vehicles more susceptible to structure borne noise. The focus of our research is to create a semi-active bushing to minimize this noise.</p>  <p>2004 Acura Integra Sedan, 1.8L 160hp</p>	<p>TEST SETUP</p> <p>Data Acquisition</p> <ul style="list-style-type: none"> • The vehicle drive (D3020) accelerometer • An Auto 21 (D3020) accelerometer <p>Test Procedure</p> <ol style="list-style-type: none"> 1. Drive on a test track at 60 km/h 2. Drive on a test track at 100 km/h 3. Compare the noise levels during 1 & 2 
<p>MODIFIED BUSHING</p>  <p>It is modified by being designed to be a 1/2" thick (using 1/2" thick) and 1/2" wide (using 1/2" thick) and 1/2" high (using 1/2" thick).</p> 	<p>ELECTROMAGNETS</p> <p>The electromagnetic system is designed to provide a semi-active bushing support that will allow the vehicle to absorb the impact of the road.</p> <p>Design Challenge</p> <p>Designing an appropriate system to provide a semi-active bushing support that will allow the vehicle to absorb the impact of the road.</p>  
<p>MR FLUIDS</p> <p>Magneto-rheological (MR) fluids are composed of oil, iron particles (0.1µm to 10µm), approximately 20-30% by volume, suspended in a base oil (oil, mineral, or synthetic oil).</p> <p>MR fluids change from a free flowing liquid to a thick gel like substance with an applied magnetic field.</p> 	<p>RESULTS/REMARKS</p> <p>Results:</p> <p>It is found that the noise level is reduced by 10% during the test.</p> <p>It is also found that the noise level is reduced by 10% during the test.</p> <p>Remarks:</p> <p>It is found that the noise level is reduced by 10% during the test.</p>

Auto 21 Reducing Structure Borne Noise: The Development of a Semi-active Bushing
 Michael Sjoerdsma, Nakul Verma
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PURPOSE

Car manufacturers are reducing the mass of automobiles in order to increase the fuel economy of their vehicles. Although this reduction of mass has positive benefits, it also makes newer vehicles more susceptible to structure borne noise. The focus of our research is to create a semi-active bushing to minimize this noise.



Colour

Reducing Structure Borne Noise: The Development of a Semi-active Bushing
 Michael Sjoerdama, Hetal Verma, and Ash Parameswaran
 Dept. PD ECU/Env. Res. University

PURPOSE
 Car manufacturers are reducing the mass of automobiles in order to achieve the fuel economy of their vehicles. Although this reduction of mass has positive benefits, it also makes some vehicle mass susceptible to structure borne noise. The focus of our research is to create a novel active bushing to minimize the noise.

TEST SETUP
 Data Acquisition
 - The endopressure (EOP) sensor
 - An ADXL345 digital accelerometer
 Test Procedure

MODIFIED BUSHING
 It is called as Energy Drain (ED) Bush Spring Bushing and tested a magnetic bushing for semi-active MR fluid.

MR FLUIDS
 Magnetorheological (MR) fluid is composed of oil, fine particles (0.1µm to 10µm), approximately 20-40% by volume, suspended in a base glycol, mineral, or synthetic oil.

RESULTS/REMARKS
 Findings:
 1. The overall reduction in the vibration transmission of the bushing between 100Hz to 150Hz.
 2. The damping ratio has showed a 10% reduction in the transmission of vibration when the magnetic field was introduced into the system.
 Findings:
 It is an actively manufacturing a new bushing using rubber rollers to reduce the mass of automobile.

Reducing Structure Borne Noise: The Development of a Semi-active Bushing
 Michael Sjoerdama, Hetal Verma, and Ash Parameswaran

PURPOSE

ELECTTOMAGNETS

RESULTS

CONCLUSION

White Space

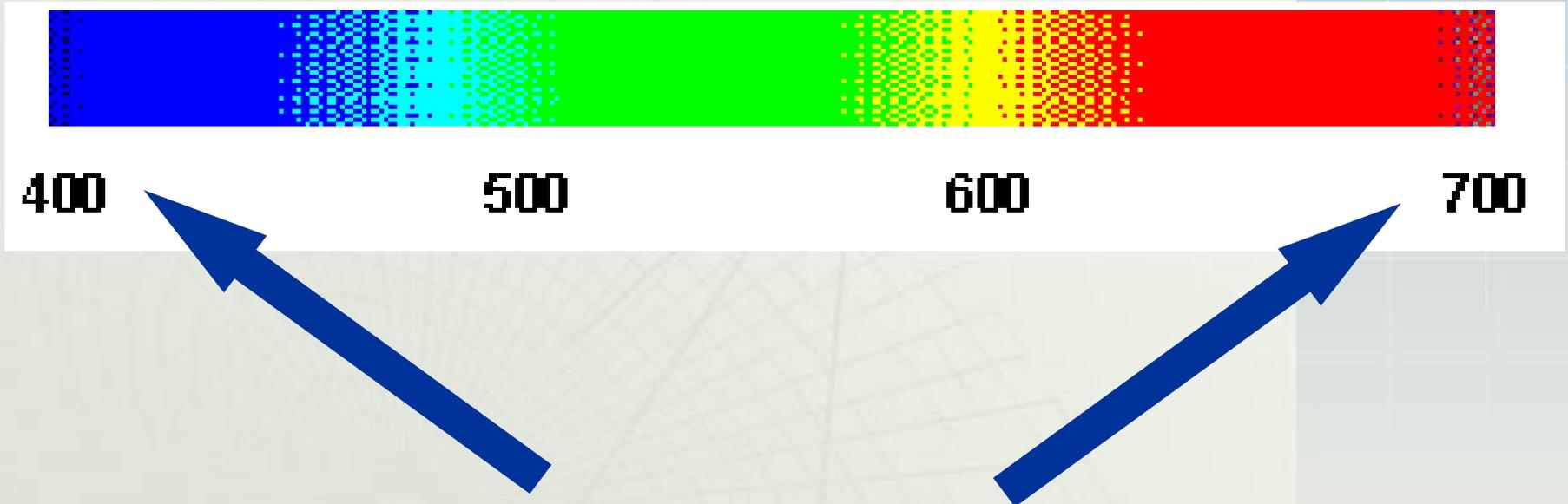


Colour

Contrast



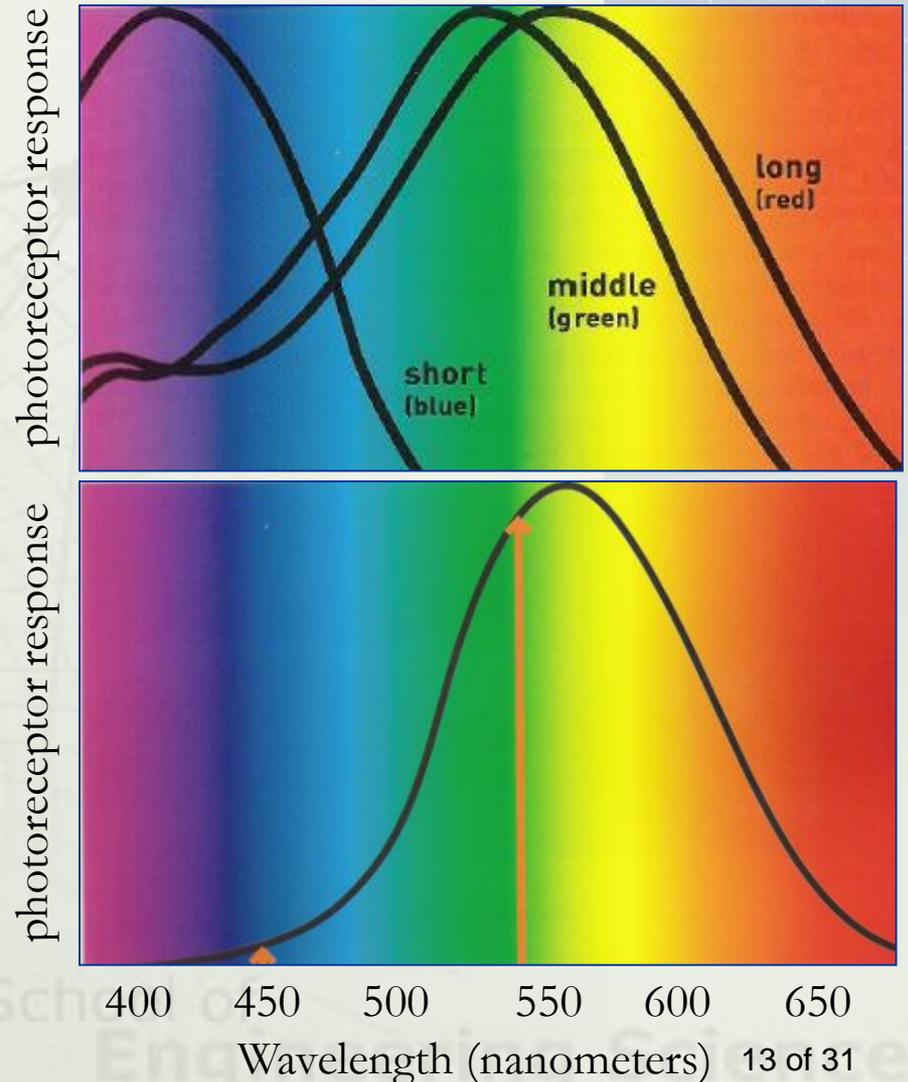
Colour



- Avoid using colours from the opposite ends of the spectrum

Colour

- Green 20 : Blue 1
- Pure blue should not be used for text, thin lines, or small objects
- Blue is good for backgrounds





Pixelation





Other Issues

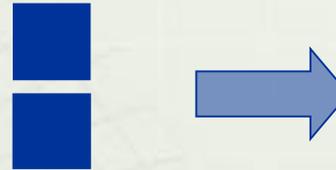
- Too much text – use point form !!

- Faulty Alignment

<p>Introduction</p> <p>Currently, car manufacturers are reducing the mass of automobiles in order to increase the fuel economy of their vehicles [1]. Although this reduction of mass has positive benefits, it also makes newer vehicles more susceptible to structure borne noise. This susceptibility to increased noise is a major concern that must be addressed by future car manufacturers because vibrations in the automobile's cabin are distracting to the driver. Distractions can cause fatigue which can jeopardize the safety of the occupants of the vehicle.</p> <p>An approach to help minimize structure borne noise is to modify the traditional passive spring-damper system with actuators placed in series or parallel with these existing components. Other researchers are modifying the traditional suspension systems of automobiles by introducing semi-active components. Sadok et al. [2], have shown that electrotheological fluid in a damper can change the damping characteristics. Our research focuses on novel techniques of creating semi-active bushings utilizing magnetotheological fluid (MRF).</p> <p>Suspension Background</p> <p>The suspension of an automobile has several functions which include maintaining road-tire contact, enhancing handling performance, and minimizing forces to the occupants of the vehicle [3]. The majority of consumer vehicles have passive suspension systems consisting of springs and dampers. The major limitation of an automobile's suspension is that a tradeoff between ride quality and suspension exists [4]. That is, a passive car suspension cannot deliver optimal ride comfort while still delivering optimal handling performance.</p>	<p>Bushings</p> <p>Bushings are used in vehicle suspensions wherever the suspension meets the chassis of the automobile. Similar to the tradeoff found in a passive suspension, bushings compromise between reducing vibration transmission and handling performance. Commercially available cars have bushings made from rubber that limit unwanted noise while introducing play into the suspension system.</p> <p>Many car enthusiasts replace the stock bushes that come with their automobile with polyurethane bushes that increase performance of the automobile. Although these may improve the suspension to a certain degree, the bushes are still passive elements and suffer from the vibration and handling trade off.</p> <p>Active and Semi-active Suspensions</p> <p>Changing the passive suspension system of an automobile to an active suspension has been the focus of much research. The suspension is changed by adding an actuator in series or parallel with the existing components. However, active suspension systems are notorious for their complexity and high power consumption [6], [7]. Other researchers have created semi-active suspensions by introducing components that have adaptive damping. These semi-active components do not introduce energy into the system; instead they vary how much energy the system absorbs [8], [9].</p> <p>Our modified bushing is a semi-active system which uses MRF to change its damping properties.</p> <p>Magnetotheological Fluid</p> <p>Our semi-active bushing uses MRF to change the</p>
---	--

Screen View

Printed View



- Full justification – use hyphens !



Other Issues

- Background Images
- Font Size

Microfabricated Biochip

Pathogen Identification

Sureswaran, Marek Syrzycki, and Paul Li



Issues

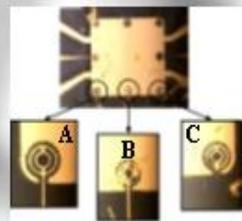
Process

layer of titanium and then
of gold
; a photolithographic process
the photoresist, expose, and
and pattern titanium using

glass slide
to glass slide

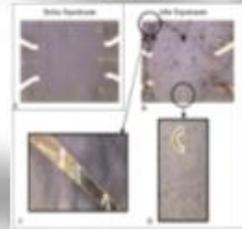
slide

Chip Issues



Fabrication Issues

- A) Properly developed probe
- B) Underdeveloped probe
- C) Overdeveloped probe



Experimental Issues

- A) Chip before experiment
- B) Chip after experiment
- C) Close up of damaged trace
- D) Close up of damaged probe

DNA Concentration on a Microfabricated Biochip

Submitted for Greenhouse-Open Pathogen Identification
Marek Syrzycki, Marek Syrzycki, Ash Paul

Concept Overview

General Problem:

How does the concentration of the probe on the microchip affect the detection of the target DNA?

Keyed Objectives:

1. Develop a microchip with a defined probe concentration.

2. Measure the concentration of the probe on the microchip.

3. Measure the concentration of the target DNA on the microchip.

Fabrication Process

1. Clean the glass slide.

2. Deposit a thin layer of titanium on the glass slide.

3. Deposit a thin layer of gold on the titanium layer.

4. Pattern the gold layer using photolithography.

Chip Issues

Fabrication Issues:

- 1. Adhesion of gold
- 2. Uniformity of gold
- 3. Contamination

Experimental Issues:

- 1. The heterogeneity of the chip
- 2. The damage to the chip
- 3. The damage to the probe

Chip Design

The chip is designed to be a 10x10 mm square.

DNA Basics

The DNA sequence is A-T-G-C.

Chip Operation

1. Clean the chip.
2. Deposit the probe.
3. Measure the probe concentration.
4. Measure the target DNA concentration.

Remarks

The chip is designed to be a 10x10 mm square.



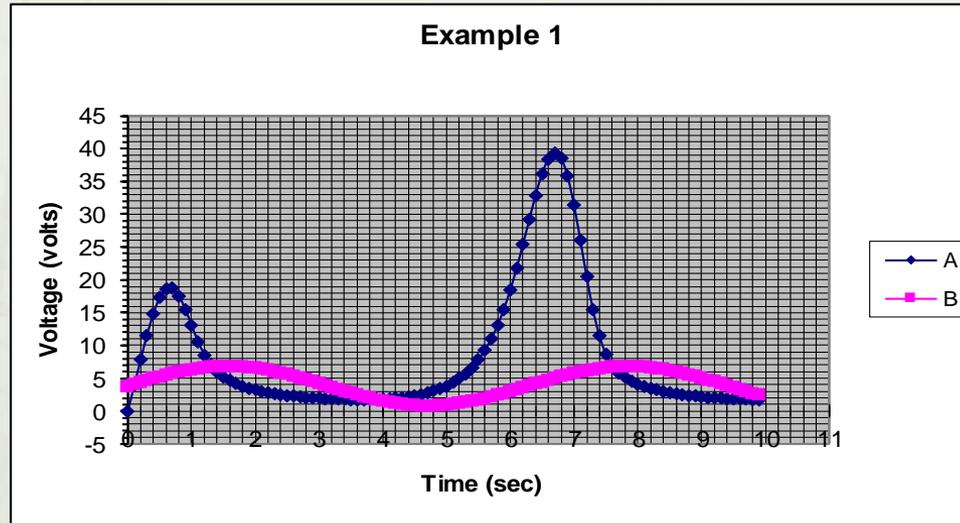
Maximize Data-Ink Ratio (Tufte)

$$\text{Data-Ink ratio} = \frac{\text{Data-Ink}}{\text{Total ink used to print the graphic}}$$

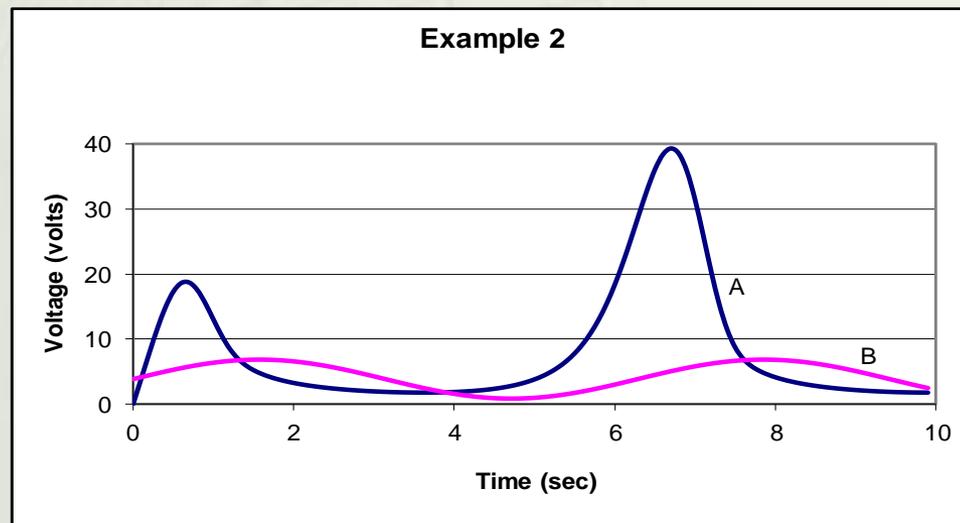


Example Data-Ink Ratio in Graphs

➤ **More Total Ink** than *Data Ink*



➤ **Less Total Ink** than *Data Ink*





Formal Poster 1: The Poster Walk

Novel Inductorless Oscillators and Dividers

Introduction

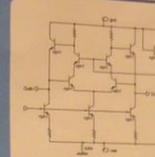
Monolithic inductors generally have poor quality factors (i.e. $Q < 20$) and consume large chip areas. When these low quality inductors are used in a parallel resonant structure, such as an LC-tank for a voltage controlled oscillator (VCO), a low quality factor equivalent resonant structure results. However some designs do not require high Q's. For designs with reduced Q requirements, an inductorless design may offer the necessary performance at a cost of increased noise, but with significant area savings. (Recall that a real LC-tank appears purely resistive at resonance.)

In [1], it was demonstrated that an inductorless VCO with large tuning range (3 GHz) and an acceptable phase noise of -87 dBc/Hz at a 1 MHz offset from a 25 GHz carrier tone was achievable in a 45 GHz SiGe technology. The concept of utilizing inductorless circuit topologies at RF frequencies was further extended in [2] by developing an inductorless quadrature voltage controlled oscillator (QVCO), and in [3] through the development of an inductorless injection locked frequency divider (ILFD). These additional projects are the focus of this work.

It is natural for the VCO and dividers to be of a similar architecture. For example, if the tuning range is improved (degraded) due to a process variation, the acceptable input frequency range of the dividers may be improved (degraded) by the same mechanism. Current research is focused on the implementation of a inductorless QVCO integrated with several cascaded inductorless ILFDs.

[1] Joshua K. Norkko and James W. Hoopes, "An Inductorless Quadrature Voltage Controlled Oscillator Design for a 45 GHz SiGe Process," The 3rd Annual IEEE NorthWest Workshop on Circuits and Systems, Vancouver, June 20-22, 2006.
[2] Joshua K. Norkko and James W. Hoopes, "A Novel 10 GHz Inductorless Quadrature Voltage Controlled Oscillator," The 16th Annual IEEE NorthWest Workshop on Circuits and Communications, Calgary, July 12-14, 2004.

Differential Inductorless VCO [1]



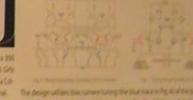
An inductorless differential voltage controlled oscillator (DVCO) was developed by Sarici et al. (Fig. 11[1]). The VCO tuned from 22.5 GHz to 25.5 GHz and had an output power variation from -10 dBm to -50 dBm (Fig. 2).

Two of our goals were to further improve the tuning range while reducing the output power variation. These were achieved with the new inductorless quadrature VCO and the new injection locked divider topologies.

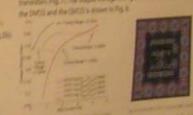
[1] Sarici, B., Ozdemir, N., Sarici, C.A., "Differential Voltage Controlled Oscillator with Large Tuning Range and Low Output Power Variation," IEEE Transactions on Microwave Theory and Techniques, vol. 54, no. 12, pp. 3485-3491, Dec. 2006.

Inductorless High Tuning Range Quadrature VCO

Quadrature voltage controlled oscillators (QVCOs) are inductors for many applications require inductive inductors and often a noise tuning method has been developed (Fig. 3). Phase noise is -110 dBc/Hz at 1 MHz offset from a 25 GHz carrier was obtained over process variations.



The design of the low-consumption quadrature VCO is shown in Fig. 4. The quadrature switching transistors (the red transistors in Fig. 5), which are placed in parallel with the differential VCO core. The new architecture is capable of providing a large tuning range (4 GHz) with reduced output power variation (Fig. 6). A direct comparison of using single inductors can be made by observing the phase noise of the quadrature switching transistors placed in parallel in the differential VCO (EMCC) compared to allowing the full current of the core to flow through the quadrature VCO (Fig. 7). The output voltage swing across the load capacitance (C_L) of the QVCO and the QVCO is shown in Fig. 8.



[1] Joshua K. Norkko and James W. Hoopes, "An Inductorless Quadrature Voltage Controlled Oscillator Design for a 45 GHz SiGe Process," The 3rd Annual IEEE NorthWest Workshop on Circuits and Systems, Vancouver, June 20-22, 2006.

10 GHz Integrated Analog Dividers

A novel injection locked frequency divider (ILFD) was developed (Fig. 3). The frequency response of the feedback loop is sensitive to parasitic capacitances at the collectors of transistors Q4 and Q5. For the frequency divider application it is useful to exploit the effects of capacitances C1 and C2. Using dominant capacitances C1 and C2 in the feedback loop (much larger than transistor parasitics), the centre operating frequency of the divider can be easily adjusted.



[1] Joshua K. Norkko and James W. Hoopes, "A Novel 10 GHz Inductorless Quadrature Voltage Controlled Oscillator," The 16th Annual IEEE NorthWest Workshop on Circuits and Communications, Calgary, July 12-14, 2004.

Acknowledgements

- Canadian Microelectronics Corporation (CMC)
- Natural Sciences and Engineering Research Council of Canada (NSERC)
- Alberta Informatics Circle of Research Excellence (ICORE)
- Telecommunications Research Laboratories (TRLabs)
- Department of Electrical and Computer Engineering, University of Calgary

10 GHz Integrated Analog Dividers

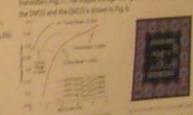
This inductorless divider architecture can be designed to operate with reduced power consumption if RL is large - at a cost of higher phase noise. Since the injection locked frequency divider is in essence an oscillator which phase locks to the signal applied to the base of Q1, for a divider-by-2 function, the ILFD operates at half of the input signal frequency - in this case 5 GHz.



[1] Joshua K. Norkko and James W. Hoopes, "A Novel 10 GHz Inductorless Quadrature Voltage Controlled Oscillator," The 16th Annual IEEE NorthWest Workshop on Circuits and Communications, Calgary, July 12-14, 2004.

Inductorless High Tuning Range Quadrature VCO

The design of the low-consumption quadrature VCO is shown in Fig. 4. The quadrature switching transistors (the red transistors in Fig. 5), which are placed in parallel with the differential VCO core. The new architecture is capable of providing a large tuning range (4 GHz) with reduced output power variation (Fig. 6). A direct comparison of using single inductors can be made by observing the phase noise of the quadrature switching transistors placed in parallel in the differential VCO (EMCC) compared to allowing the full current of the core to flow through the quadrature VCO (Fig. 7). The output voltage swing across the load capacitance (C_L) of the QVCO and the QVCO is shown in Fig. 8.

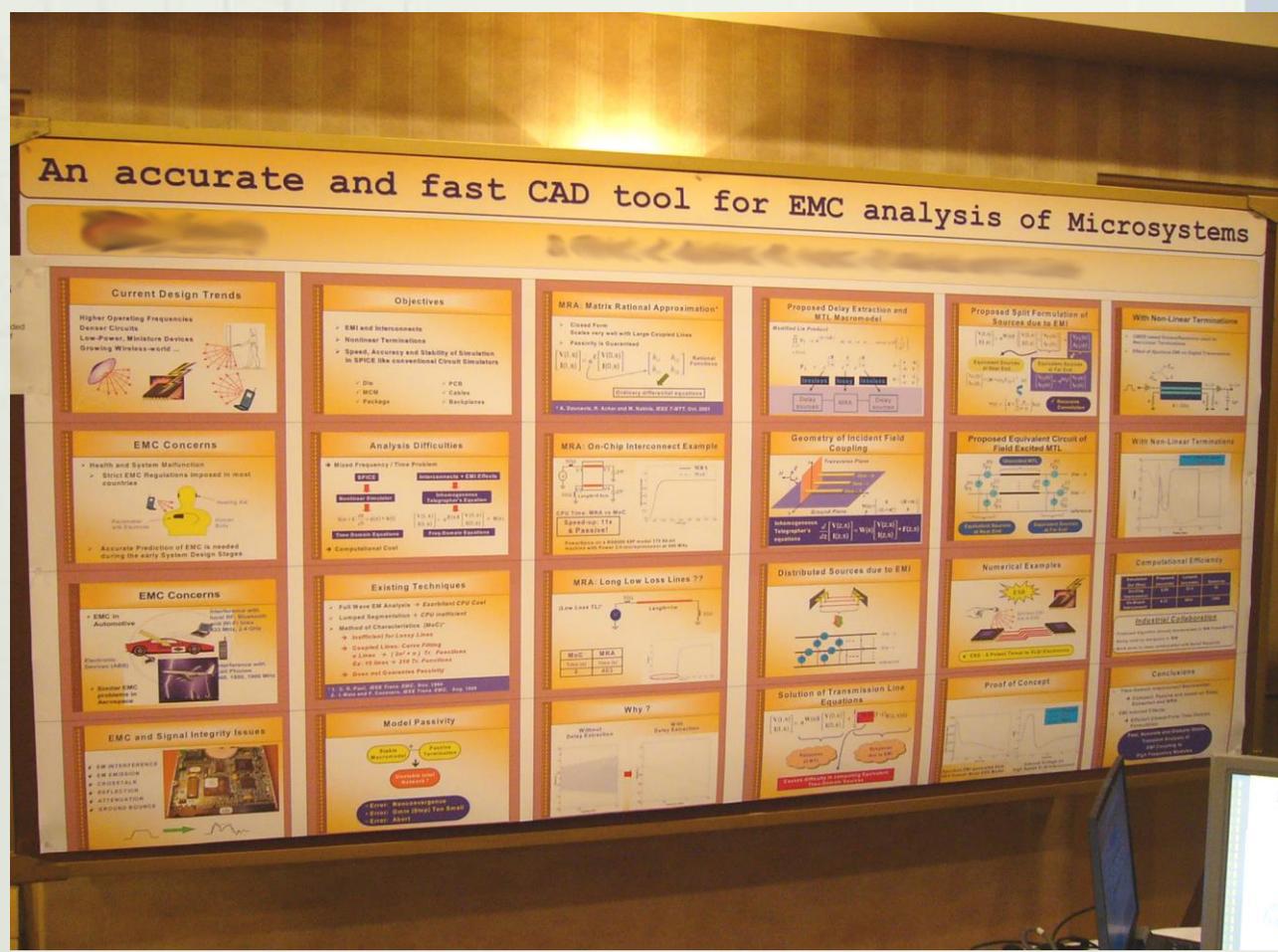


[1] Joshua K. Norkko and James W. Hoopes, "An Inductorless Quadrature Voltage Controlled Oscillator Design for a 45 GHz SiGe Process," The 3rd Annual IEEE NorthWest Workshop on Circuits and Systems, Vancouver, June 20-22, 2006.

Joshua Norkko and Dr. Jim Hoopes

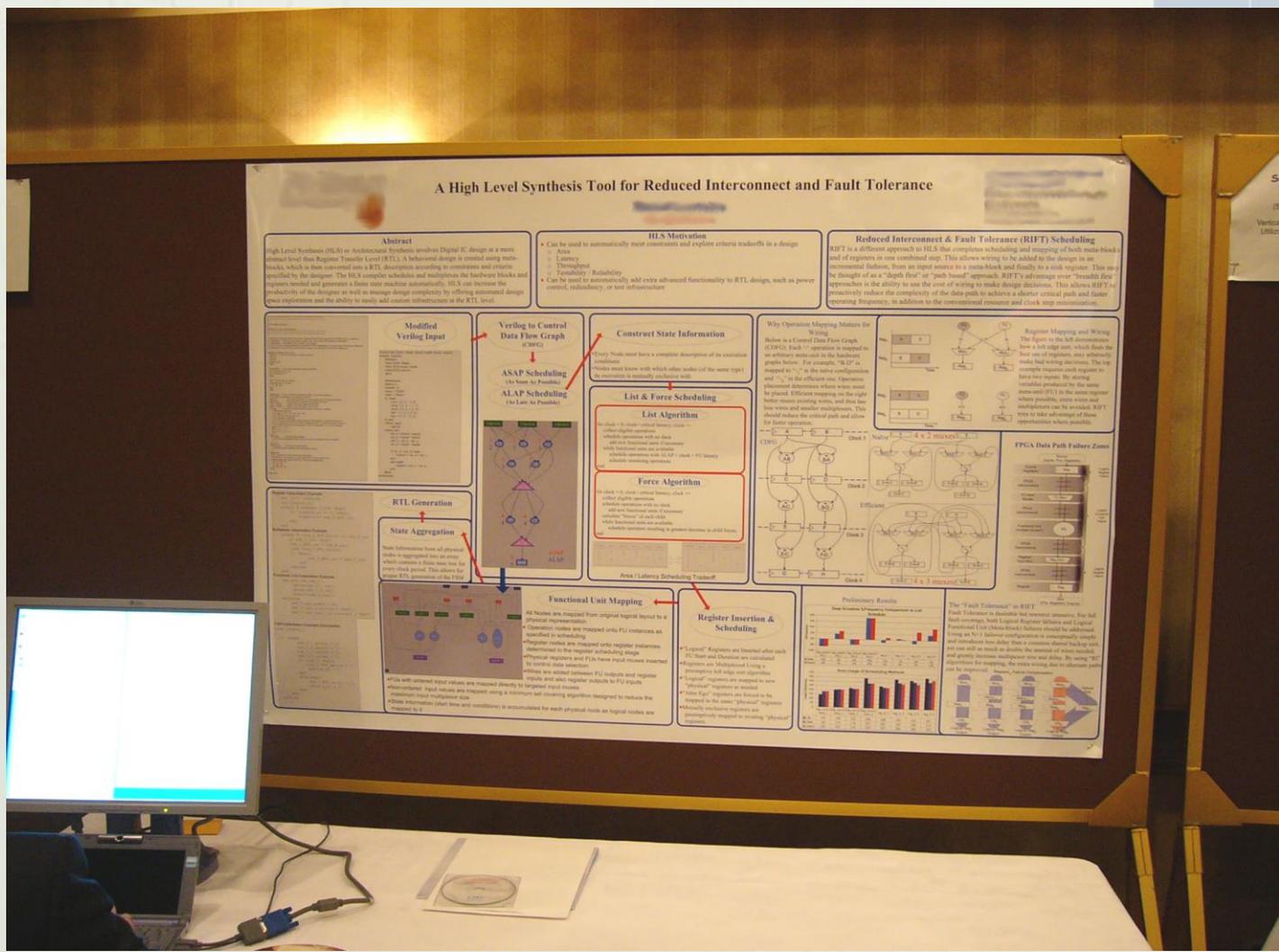


Formal Poster 2: The PP Poster





Formal Poster 3: The Maze Poster



A High Level Synthesis Tool for Reduced Interconnect and Fault Tolerance

Abstract
High Level Synthesis (HLS) or Architectural Synthesis involves Digital IC design at a more abstract level than Register Transfer Level (RTL). A behavioral design is treated using meta-blocks, which is then converted into a RTL description according to constraints and criteria specified by the designer. The HLS compiler schedules and maps the hardware blocks and registers needed and generates a finite state machine automatically. HLS can increase the productivity of the designer as well as manage design complexity by offering automated design space exploration and the ability to easily add custom infrastructure at the RTL level.

HLS Motivation

- Can be used to automatically meet constraints and explore criteria tradeoffs in a design
 - Area
 - Latency
 - Throughput
 - Testability / Reliability
- Can be used to automatically add extra advanced functionality to RTL design, such as power control, redundancy, or test infrastructure

Reduced Interconnect & Fault Tolerance (RIFF) Scheduling
RIFF is a different approach to HLS that combines scheduling and mapping of both meta-blocks and of registers in one combined step. This allows wiring to be added to the design in an occasional fashion, from an input source to a meta-block and finally to a sink register. This may be thought of as a "depth first" or "path based" approach. RIFF's advantage over "breadth first" approaches is the ability to use the cost of wiring to make design decisions. This allows RIFF to proactively reduce the complexity of the data path to achieve a shorter critical path and faster operating frequency, in addition to the conventional resource and clock step minimization.

Modified Verilog Input

Verilog to Control Data Flow Graph (CDFG)

ASAP Scheduling (As Soon As Possible)

ALAP Scheduling (As Late As Possible)

Construct State Information

List & Force Scheduling

List Algorithm

Force Algorithm

Why Operation Mapping Matters for Wiring

Register Mapping and Wiring

Functional Unit Mapping

Register Insertion & Scheduling

RTL Generation

State Aggregation

FPGA Data Path Failure Zones

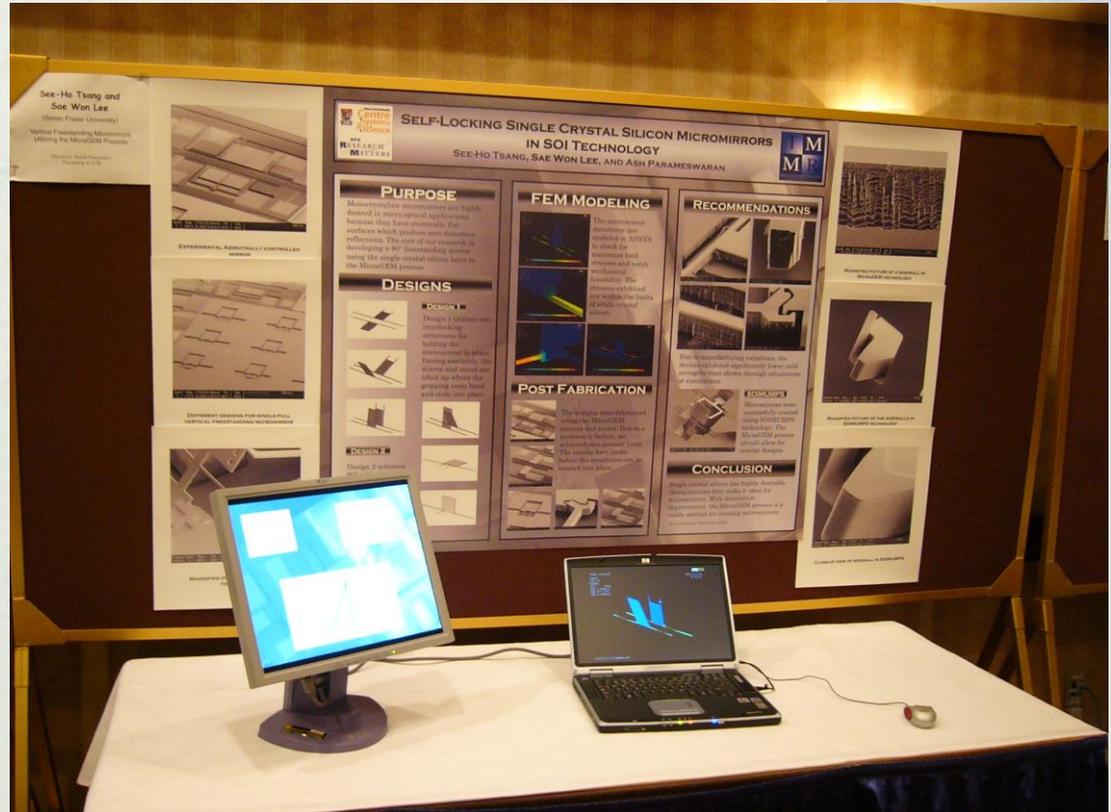
Preliminary Results

The "Path Element" in RIFF



Learning Styles

- Bring demos
- Have a computer
- Interactive elements





Gardner's Multiple Intelligences

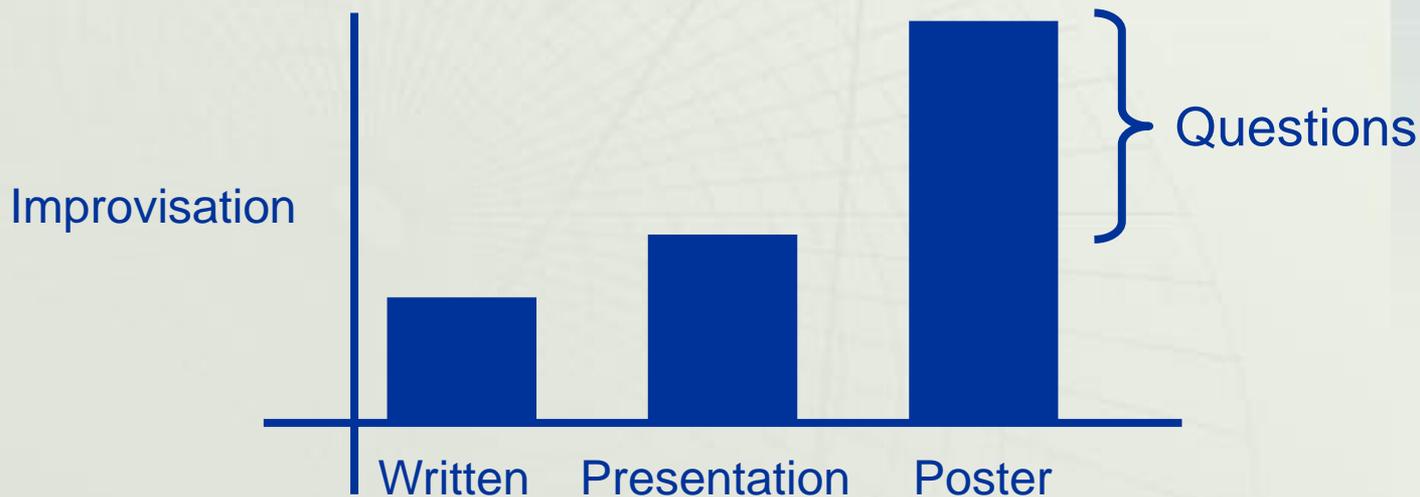
- Gardner's theory of multiple intelligences, while virtually untested after 31 years, is worth considering in teaching.
- In poster presentations, you might try some of the differing approaches illustrated.





Handling Questions

- Andrew, I, and the TA will have lots of questions
- Encourage questions/suggestions from others
- Reiterate the questions if they are unclear
- Don't make stuff up – you'll get caught. BS kills.
- Remember your audience (level of detail)





Sniff and Destroy

GROUP ETA
David Cook, Alex Finkbein, Thomas Hill, Steven Li, Roman Schuch, Anika St. Laurent, Benjamin Wu, Lucas Yuan

Mines: A Background

Introduction to Mines
- 100 million landmines
- 100 million people
- 100 million people
- 100 million people

Antipersonnel Mines

Definition
- 100 million landmines
- 100 million people
- 100 million people

VICTIMS

Humanitarian impact
- 100 million landmines
- 100 million people
- 100 million people

Urgent Removal Necessary

Urgent removal necessary
- 100 million landmines
- 100 million people
- 100 million people

SNIFF (mine detector)

Training
- 100 million landmines
- 100 million people
- 100 million people

Implementation
- 100 million landmines
- 100 million people
- 100 million people

Data Compilation
- 100 million landmines
- 100 million people
- 100 million people

DESTROY (mine elimination)

Implementation
- 100 million landmines
- 100 million people
- 100 million people

COMPARISON TO EXISTING METHODS

COST ANALYSIS

TOTAL COST: \$100,000,000	
Personnel	\$10,000,000
Equipment	\$10,000,000
Materials	\$10,000,000
Transportation	\$10,000,000
Other	\$10,000,000
Per Mine	\$100,000



UNDERWATER HABITATS

what would life be like...
being a part of a earth's new revolution...
living just two minutes away from work, shopping, groceries...
without the worries about being stuck in rush-hour traffic...
...if you lived underwater?

BACKGROUND

Global warming poses a serious immediate problem for today's rapidly growing cities. Our goal is to provide a more efficient and environmentally friendly housing solution located close to major urban areas.

Why Underwater?

- With recent housing booms, metropolitan land close to cities is quickly disappearing.
- It's a logical solution when considering the fact that 70% of the earth's surface is covered with water.
- Living closer to the water, many major cities are located near large bodies of water.

STRUCTURE

Our selected habitat is located between 3 large and small cities.

Interior

- Large surface area for windows and lighting.
- Small interior spaces for living, dining, and sleeping.
- Total interior area: 10,000 sq. ft.

Exterior

- Total surface area of 3 habitats: 300,000 sq. ft.
- 1 habitat needs to be built.
- Total of 3 habitats of selected habitat.

Artistic plans, which depict interior and exterior views of the residence capabilities required to sustain life in an underwater habitat.

Dimensions of space:

- Depth: 100 ft
- Radius: 100 ft
- Diameter: 200 ft
- Area: 31,416 sq. ft.
- Volume: 628,319 cu. ft.
- Weight: 1,256,638 lbs.



POWER

Hydroelectricity

- Tap into the city's hydroelectric plant for energy generation.
- Low cost, no fuel required.
- Minimal environmental impact since the dam is already built.
- Capable of producing up to 1000 MW of available energy and cheap electricity.
- A very flexible since it can be easily converted to wind electricity depending on the weather.
- Subsidies and tax breaks are available and already distributed.
- Electricity is abundant in the area.



Offshore Wind Farms

- To be self-sustaining, we will generate power from offshore wind farms.
- Advanced understanding and new technology has begun to reduce the cost of manufacturing and generating electricity from wind turbines.
- Wind farms yield without exception because there are no major wind speed obstructions.



Alternative Resources

- We considered using geothermal energy as being power, but the availability of such resources was expensive.
- For emergency power, we found to use biofuel from food in these marine organisms and there are no fish in these waters when normal tides.



FOOD AND WATER

Fish... lots of them

- Extensive food source as it is abundant in the marine ecosystem.
- Much more water to clean them when eaten.
- Catch fish using net and traps which are repeated every 24 hours.

Water

- All water is pumped from the edge of the city to remove salt and other minerals from the water to produce potable drinking water.
- The habitat plants will provide the growing water for the industry.

Crops

- Create a suitable space to grow fresh water crops.
- Greenhouse can be built to grow fruits and vegetables under water.
- There is a lot of space for crops to grow and water is available for the city.

Meat

- Support meat products from the surface.
- Cheaper and safer than raising animals underwater.

LIGHTING

For Plants

- The agricultural industry has developed a light bulb that can be used for lighting underwater. It is the same as the one used on the surface but it is designed to be used underwater.

For Humans

- Another type of light bulb is available for humans which is the same as the one used on the surface but it is designed to be used underwater.

WASTE

Bodily Excreta

- Excreta will be used to grow crops, being used as fertilizer in the habitat. There, water will be used to grow plants to eat and water will be used to grow crops to eat.

Gases

- With the human production of oxygen dioxide, a safe amount must be removed. Carbon dioxide will be removed by using a chemical process. The process is already in use in the habitat.

Industrial Waste

- Water and other waste will be used to grow crops and be recycled.

TRANSPORTATION

Submarine

- 60 Passenger Capacity
- Having to be used to bring the water to the habitat when not in use.
- Being tested and used as an alternate method of transport.



PSYCHOLOGICAL EFFECTS

- It is possible that one may be faced with psychological problems caused by a sudden change in environment. These can be a result of adjusting to life in an underwater habitat that requires a total change in general and primary behavior.
- Symptoms include a feeling of isolation, claustrophobia, and irritability. One may also feel a loss of light, water, and temperature.

- To avoid these problems, the habitat is prepared with the following features:
 - Large windows to provide a view of the outside world.
 - Large windows to provide a view of the outside world.
 - Large windows to provide a view of the outside world.
 - Large windows to provide a view of the outside world.

EMERGENCIES

- Most habitat disaster will not affect an underwater habitat.
- Underwater habitats, and other, will be built in a way that will ensure that all critical systems will be able to function in an emergency.
- A habitat system will be able to function in an emergency.
- A habitat system will be able to function in an emergency.
- A habitat system will be able to function in an emergency.

CONCLUSION

- Possible to design
- Many other challenges are still to be solved.
- Long-term study of self-sustaining habitats needed and it is being done and being completed in a year.
- Further improvements
- A habitat system will be able to function in an emergency.
- A habitat system will be able to function in an emergency.

ENIC: Habitat
ENIC: Habitat



Trifold Board



The Implanted Epinephrine Administration System

... an improved solution for those suffering from acute allergies

brought to you by group λ - on your wavelength

Benefits

Triggering mechanism

The Epinephrine Solution

Current Services and Problems

Empowering the Doctor

The Safety

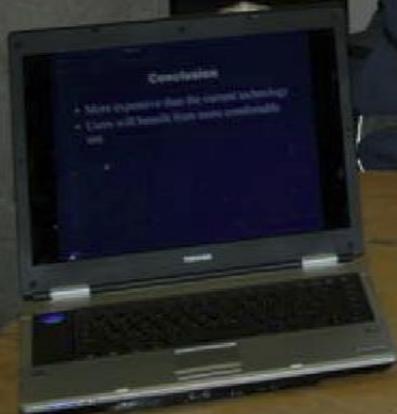
Value System

Reliability

Market Research

The Patch

Future Development



Costs

Item	Unit Price	Quantity	Total Price
Device	\$1,000	1	\$1,000
Patch	\$50	10	\$500
App	\$200	1	\$200
Training	\$100	1	\$100
Marketing	\$500	1	\$500
Legal	\$100	1	\$100
Other	\$100	1	\$100
Total			\$2,500

INTRODUCTION

Landmine detection is a critical task for military forces, and the current methods are often slow and labor-intensive. This project aims to develop a more efficient and accurate detection system.

LANDMINE DETECTION

CURRENT DETECTION METHODS

Current methods include visual inspection, metal detectors, and ground-penetrating radar (GPR). Each method has its own set of limitations, such as being slow, noisy, or requiring specialized equipment.

OUR SOLUTION

Our solution is a novel detection system that combines GPR data with machine learning algorithms. This approach allows for faster and more accurate identification of landmines compared to traditional methods.

RESULTS

The system was tested on a large dataset of GPR scans. It achieved a detection rate of 95% with a false alarm rate of only 5%. This performance is significantly better than current methods.

CONCLUSION

The proposed system represents a significant advancement in landmine detection technology. It is more efficient, accurate, and easier to use than existing methods.

REFERENCES

[List of references]

CONTACT

[Contact information]

Project Summary

This project focuses on the development of a new landmine detection system. The goal is to create a more efficient and accurate method for identifying landmines in the field.

Key Objectives

- Develop a machine learning model for GPR data analysis.
- Improve detection accuracy and reduce false alarms.
- Design a user-friendly interface for field deployment.

Methodology

The project follows a standard engineering process: problem identification, research, design, implementation, testing, and evaluation. The machine learning model was trained on a large dataset of GPR scans and tested on a separate set of data.

Results and Findings

The system achieved a 95% detection rate with a 5% false alarm rate. This performance is superior to current methods, demonstrating the effectiveness of the proposed solution.

Conclusion

The project successfully developed a novel landmine detection system. The results show that the combination of GPR and machine learning is a promising approach for this task.

Future Work

Future work includes refining the model for different soil types and testing the system in real-world conditions.



Questions?

➤ **More information:**

- Colour:
 - ✓ M. Livingstone, *Vision and Art: The Biology of Seeing*. New York: Harry N. Abrams, Inc., 2002.
 - ✓ G. M. Murch, "Physiological Principles for the Effective Use of Color," *IEEE CG&A*, pp. 49-54, November 1984.
- Graphics:
 - ✓ E. R. Tufte, *The Visual Display of Quantitative Information*. Cheshire, Connecticut: Graphics Press, 1990.