Defect Detection: How good are human observers?

A D F Clarke, Texture lab, Heriot-Watt

IMRC Conference

02/07/10

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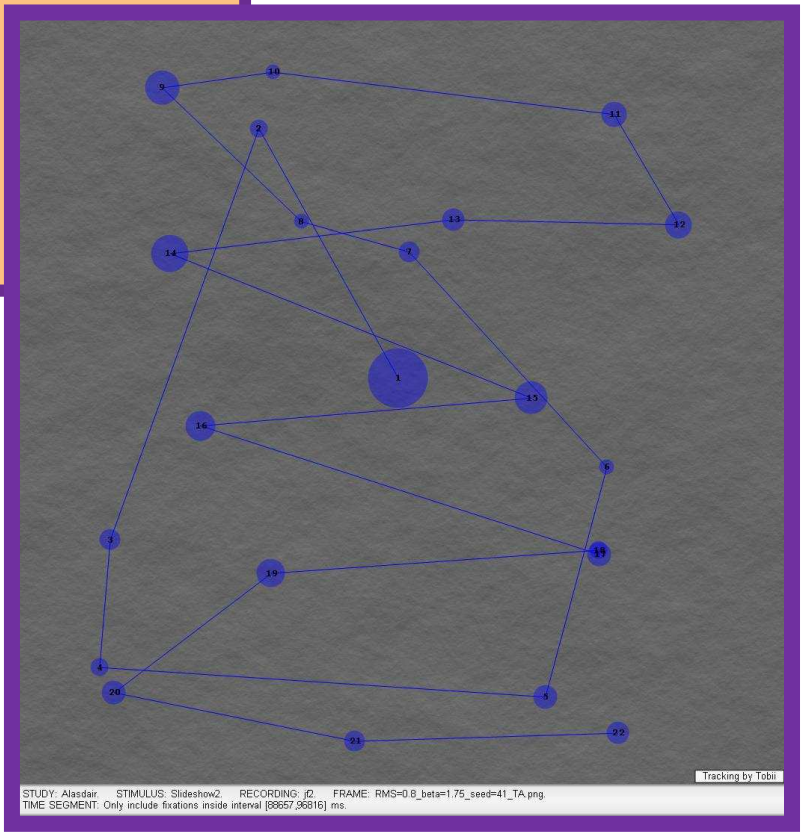
EPSRC Engineering and Physical Sciences Research Council

Perceptual Defect Detection

How well can human observers identify defects on textured surfaces?

How should we go about modelling human performance?

Can we develop defect detection algorithms which give perceptually relevant results?



Haptics, “Touching up Process Planning”

Craig Fletcher, PhD student Mech Eng Dept. Heriot Watt University

JWI Conference Digital Tools in High Value Manufacturing

2 July 2010

Haptics, “Touching up Process Planning”

Can a Haptic Virtual Environment

provide an effective environment for generating process plans ?

Operations List

Part Name		Part Number		Drawing Number				
Revision Number		Date		Planner				
Op No.	Description	Machine Tool	Tooling	Speed	Feed	Set-up Time	Op.Time	Remarks

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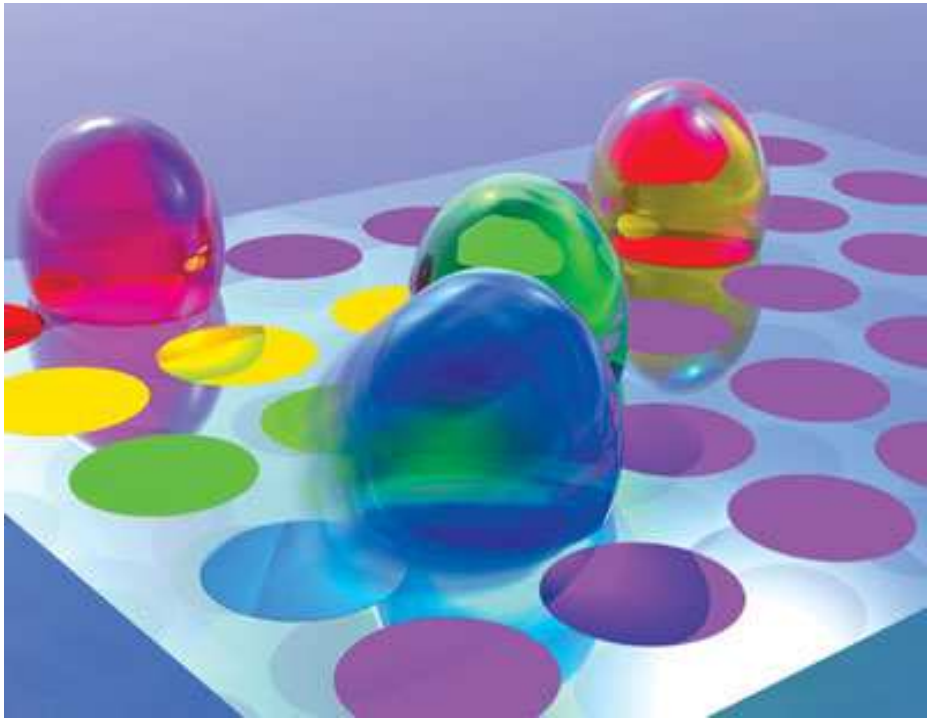
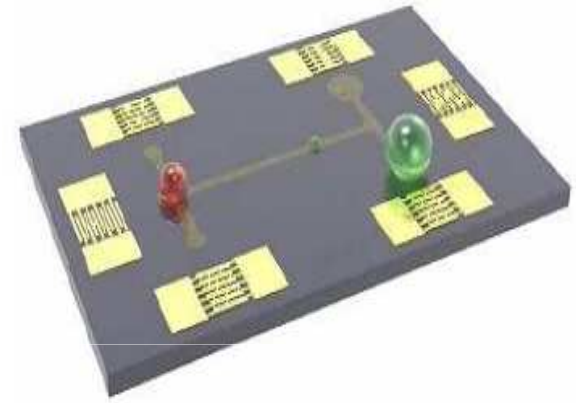
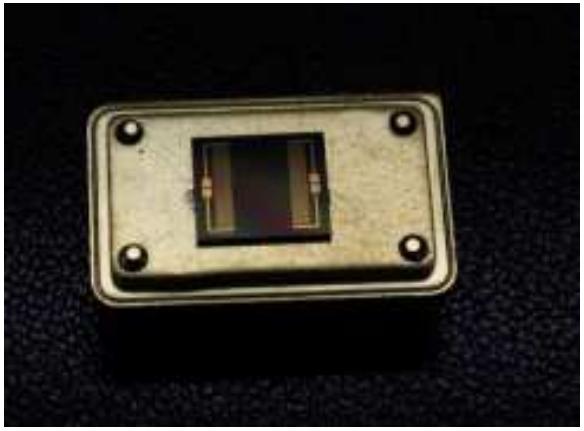
Digtial Acoustic Wave Microfludics



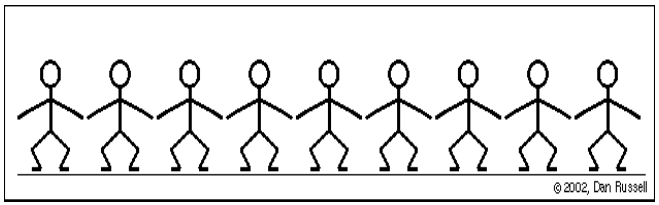


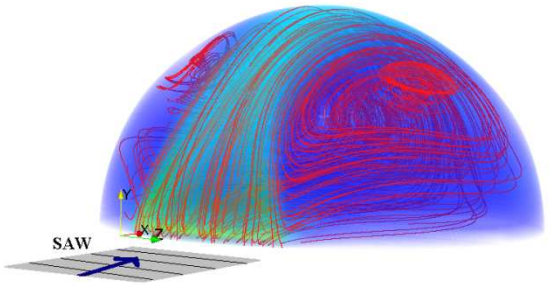


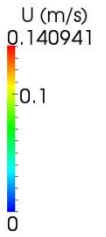
Dr. Richard Fu

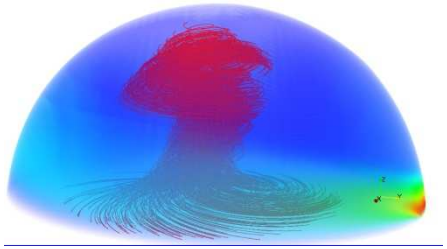
Heriot-Watt unviersity

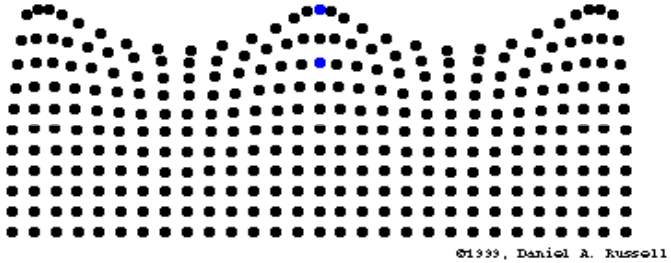
Acoustic Wave Microfluidics

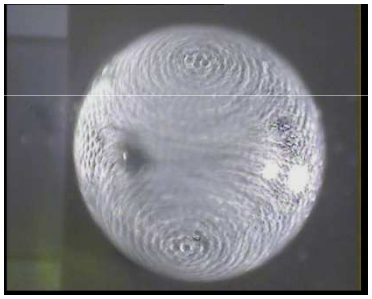


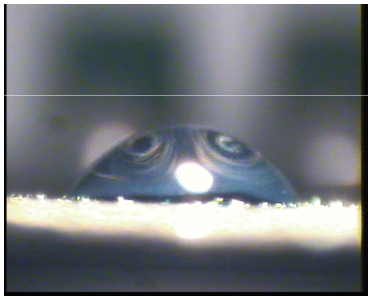


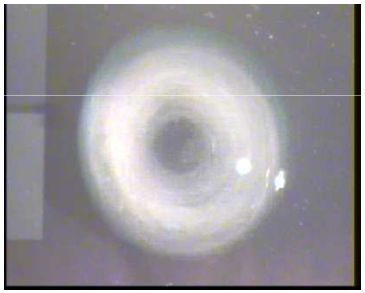


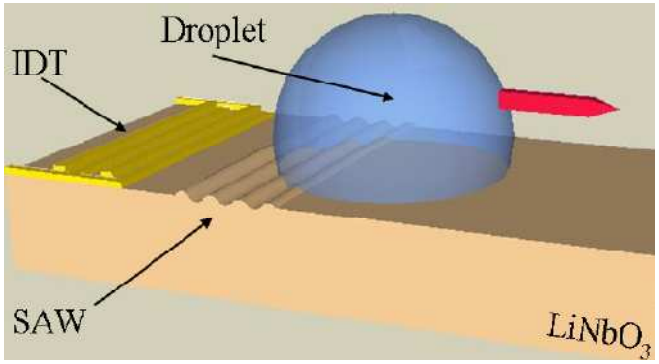


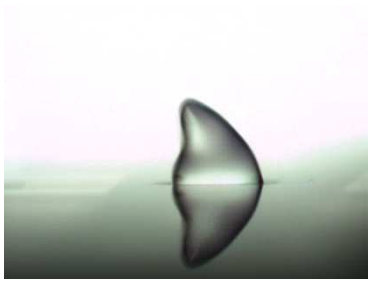


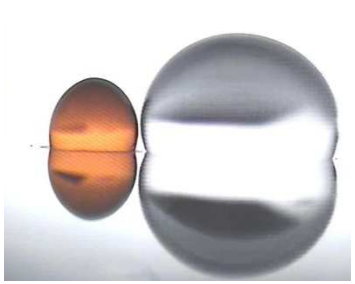




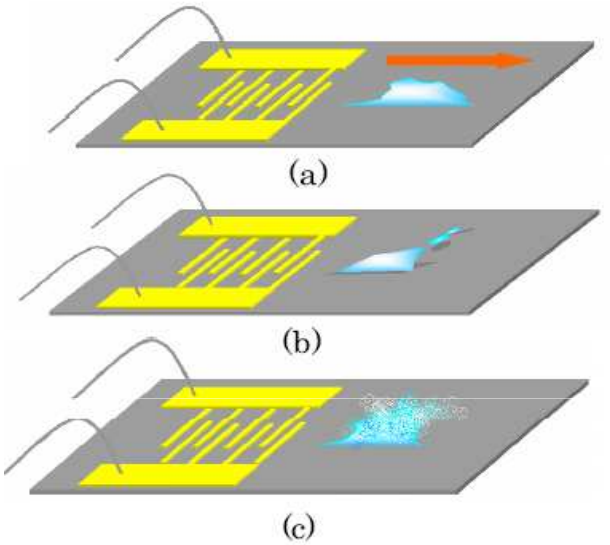


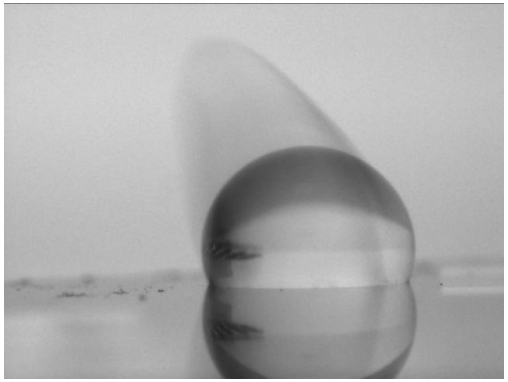


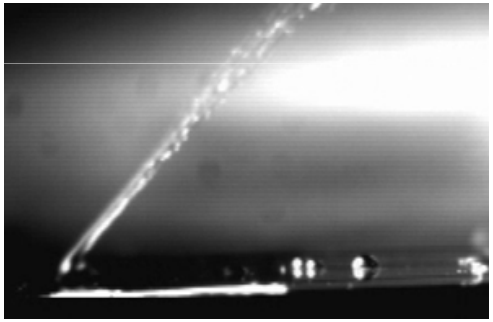


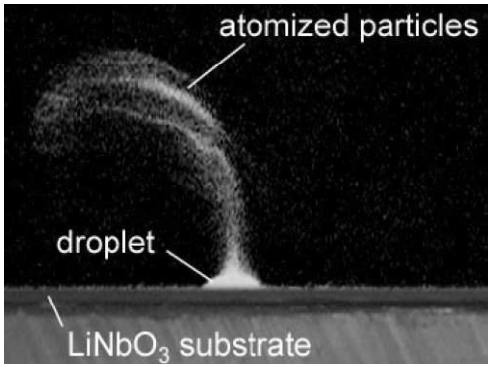


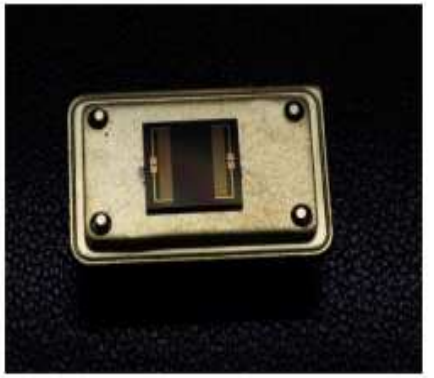
Acoustic Ejection and Sensing



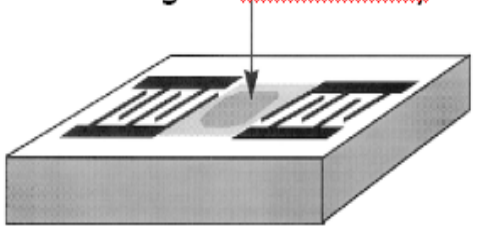


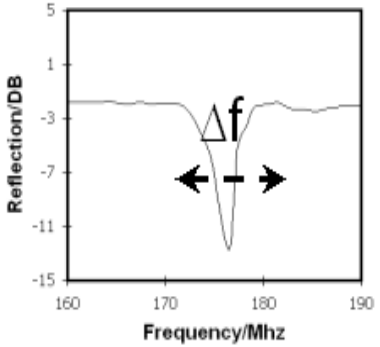






Mass loading or viscoelasticy change





Frequency change

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Texture Browsing Environments

Fraser Halley, Texture Lab

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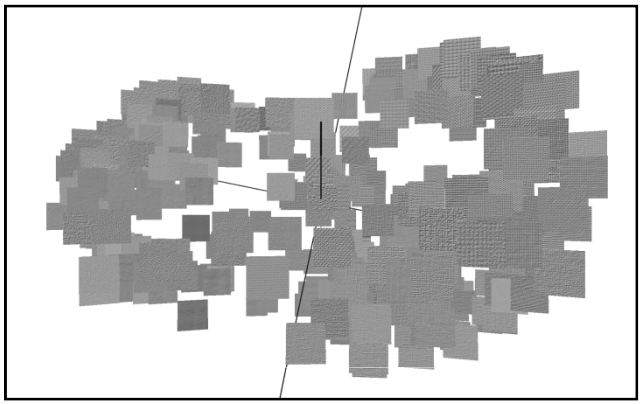
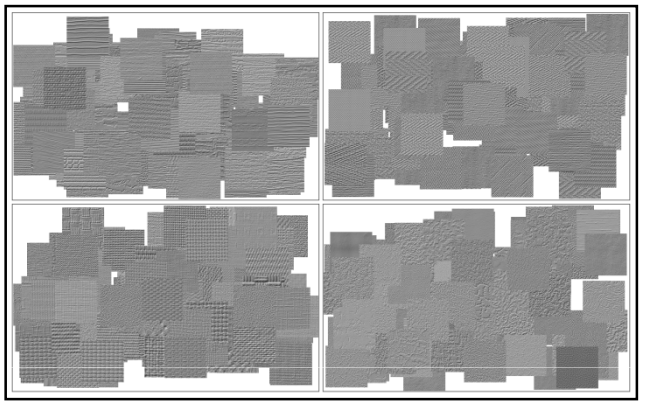
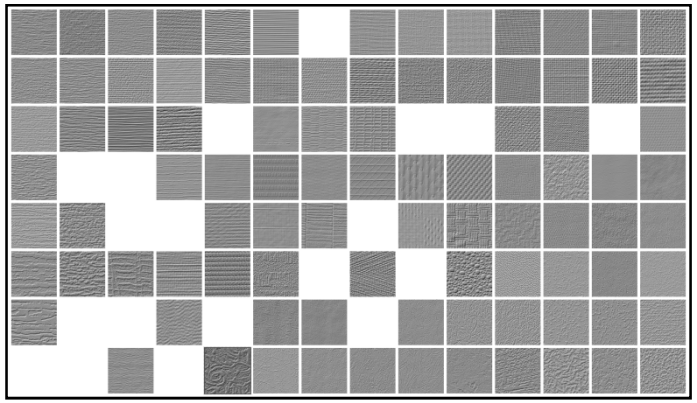
Texture Browsing Environments



3D MDS



Rapid-Fire Image Preview



SOM Grid

Creative Design of Parallel Manipulators

Xianwen Kong, Heriot-Watt University

1-Day conference of the 2010 Heriot-Watt University Innovative Manufacturing Research centre

2nd July 2010

James Watt Institute for High Value Manufacturing

Creative Design of Parallel Manipulators

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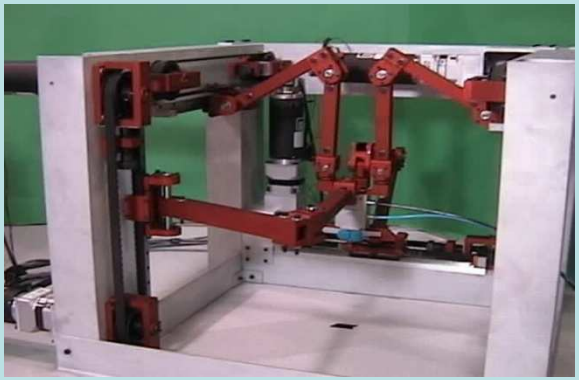
SCARA (serial) manipulator



Parallel Manipulator

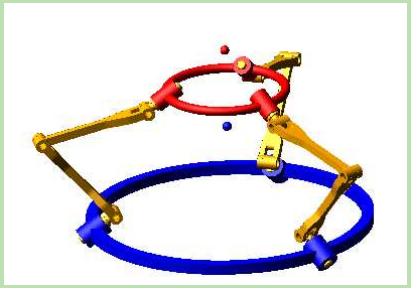
(Kong and Gosselin, US patent, 2006)

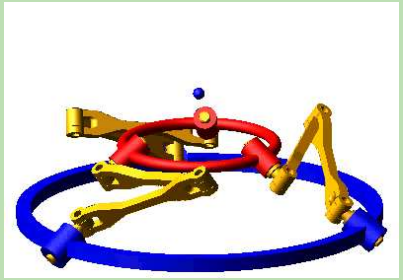
Characteristics

* High accuracy
* …

Applications

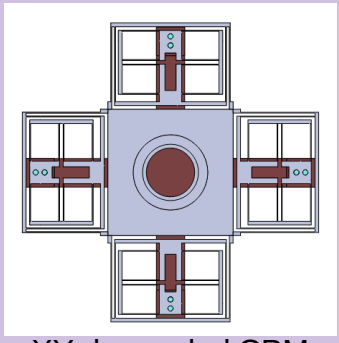
* Assembly robots
* Reconfigurable robots
* Precision motion stages
* MEMS sensors and actuators



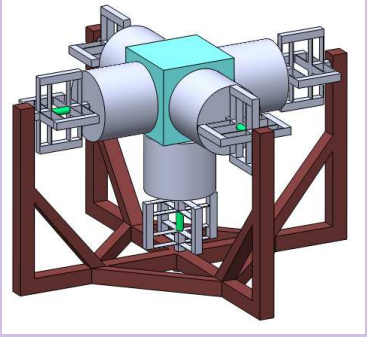


(a) Translation mode (b) Rotation mode

Multi-mode parallel manipulator



XY decoupled CPM



3-DOF decoupled CPM

Compliant parallel manipulators for translation

Evaluating game user interfaces for Engineering Tasks with Biometric logging

Zoe Kosmadoudi, PhD student in Mechanical Engineering

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2 July 2009

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EVALUATING GAME USER INTERFACES FOR ENGINEERING TASKS WITH BIOMETRIC LOGGING

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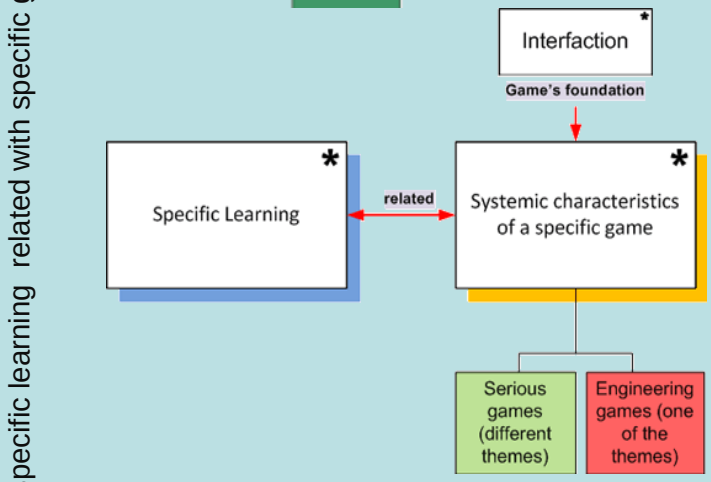
The design and complexity of a software system's user interface determines the ease with which users can effectively operate that system. Game-based approaches have proposed recently, referring to the motivational and engaging game elements that can be used to enhance engineering applications.



Specific learning related with specific game.

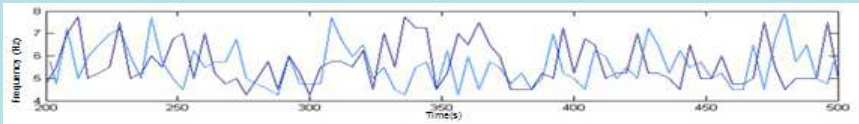
Specific game with an engineering theme?

"How do we elicit creative behavior from engineers who wish to engender a positive thinking approach to problem solving?"

Engineering application design can benefit from exploiting the game mechanisms.

And then, "How can the game-based application be evaluated?"

- Emotions play an important role in product design.
- Tracking the 'experience' of the user in the form of signals when interacting with an application can be used as indicators for usability assessment of the system.



User Emotion Capture and Analysis during Computer-Aided Design

Ying Liu, Research Associate, Mechanical Engineering,

School of EPS, Heriot Watt University

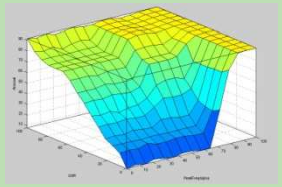
JWI Conference Digital Tools in High Value Manufacturing

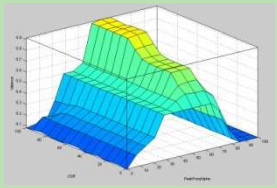
2 July 2010

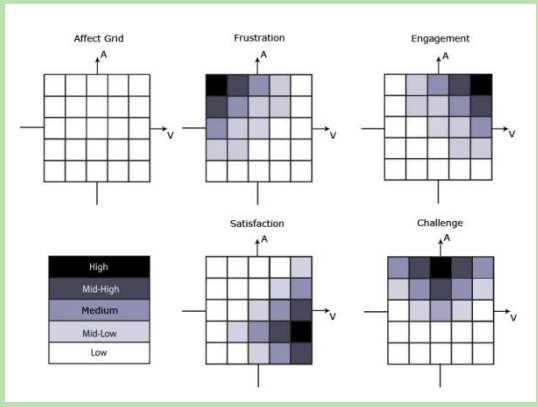
User Emotion Capture and Analysis during Computer-Aided Design

- **Natural, Intuitive** and **Human-Centred** way to Communicate with machines
- Let the **machines understand how you feels** through your **psycho-physiological signals**

- To design a car in the Solid Edge™ v20 CAD package.
- Physiological responses measured by the Nexus devices.
- Fuzzy models established.
- Preliminary results obtained.
- Four emotions are identified by the analysis of physiological signals.







- Pilot study proved certain emotions can be measured.
- Dynamic emotion status reveals the aspects causing negative emotions
- Demonstrated the real potential for a more natural evaluation of the CAD product design process.

Leak Detection Methods for Low Cavity Volume Packages

Suzanne Millar, Heriot-Watt University & MCS Ltd

Marc Desmulliez, Heriot-Watt Univeristy

Stewart McCracken, MCS Ltd

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Leak Detection Methods for Low Cavity Volume Packages

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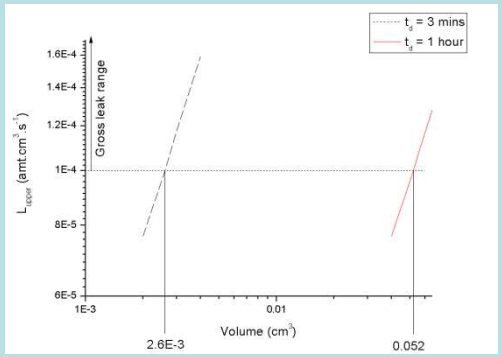
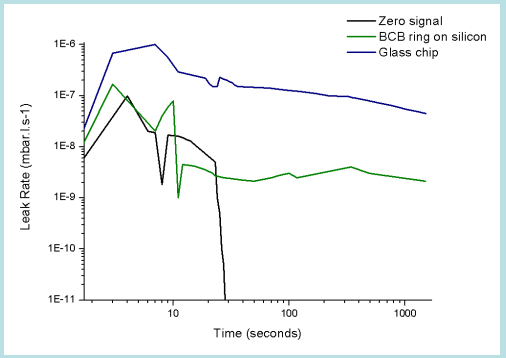
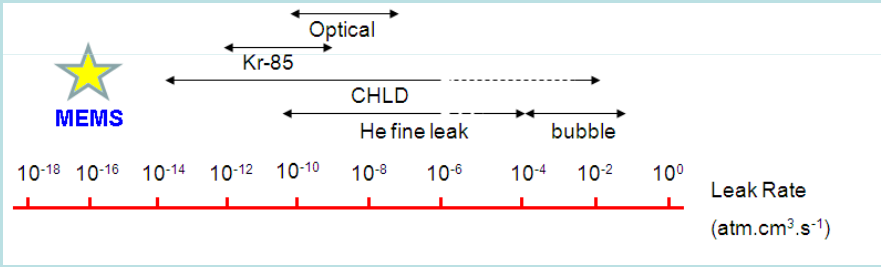
Limitations of existing methods:

- Minimum volumes
- Material types
- Minimum detectable leak rates







Solutions:

- Permeable materials – FTIR
- Failure Analysis technique/outgassing - Raman
- In-situ test structures for ultra-low leak detection

Conclusions:

Show applicable test for package types and industrial sector.

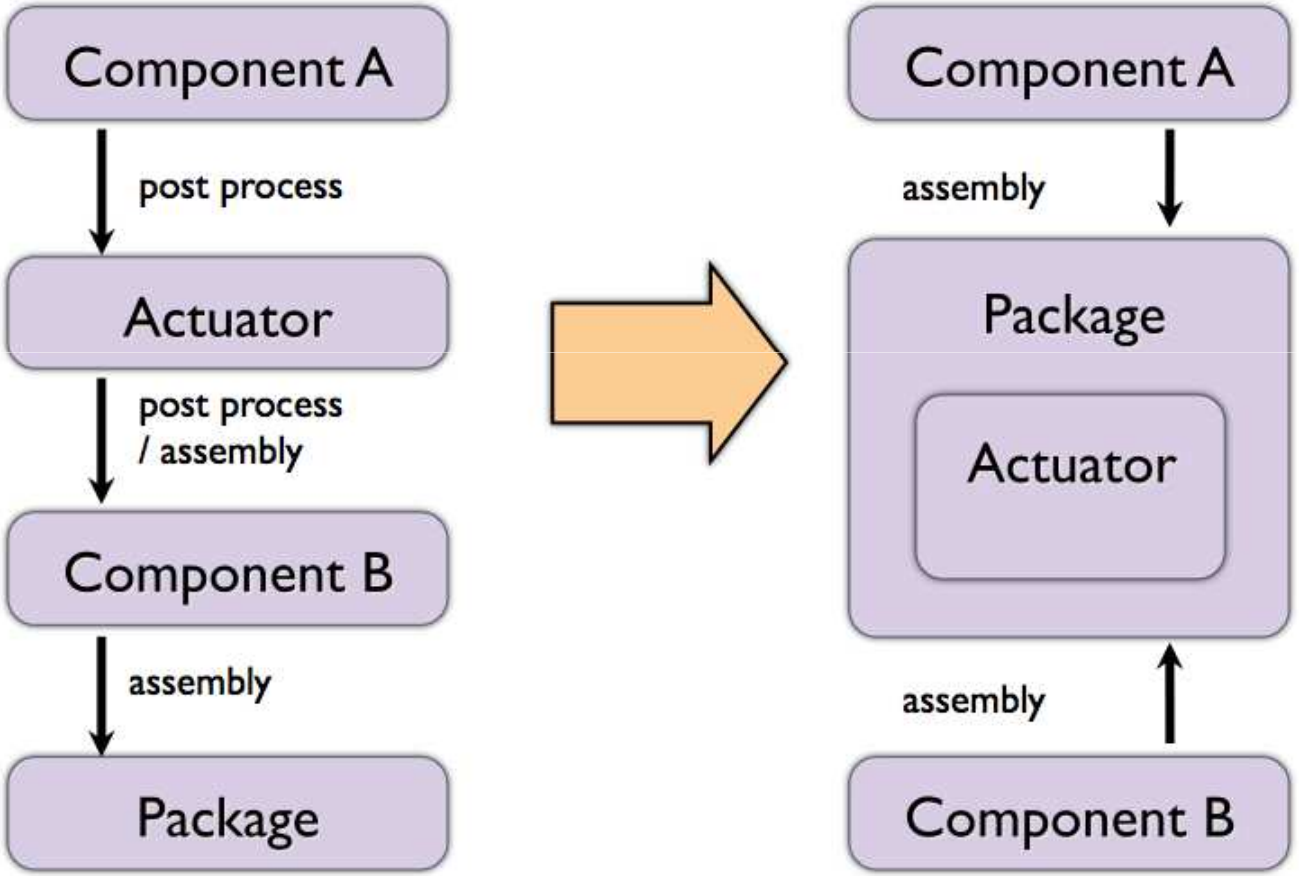
Active packaging in LTCC

Stefan Wilhelm, Heriot-Watt University

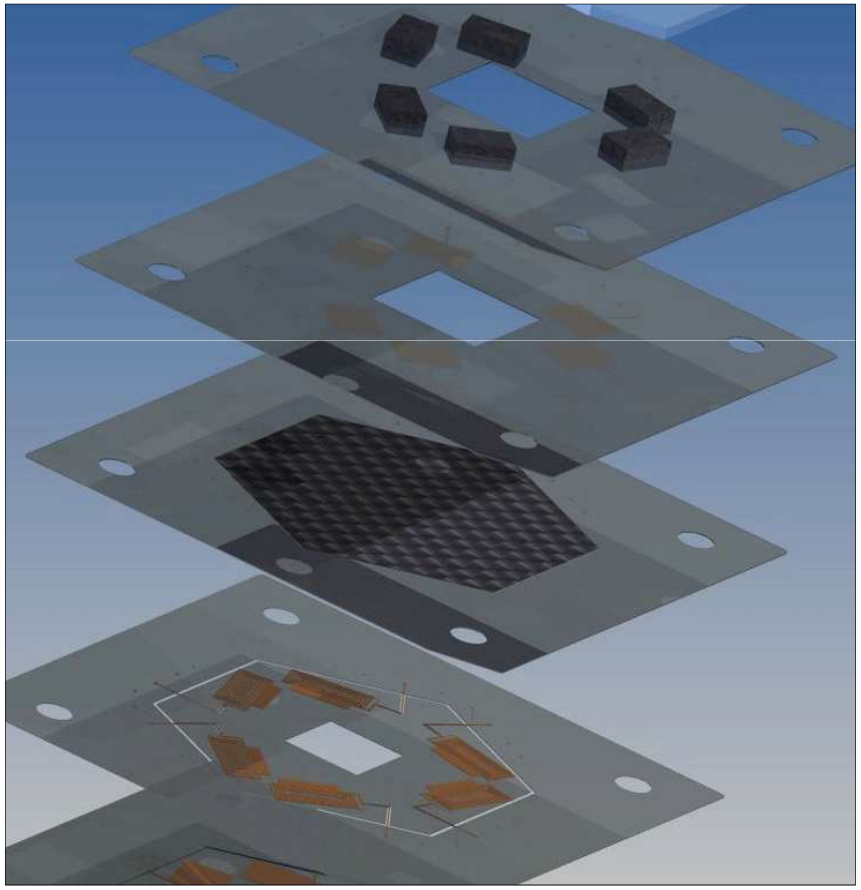
IMRC Conference

2010-07-02

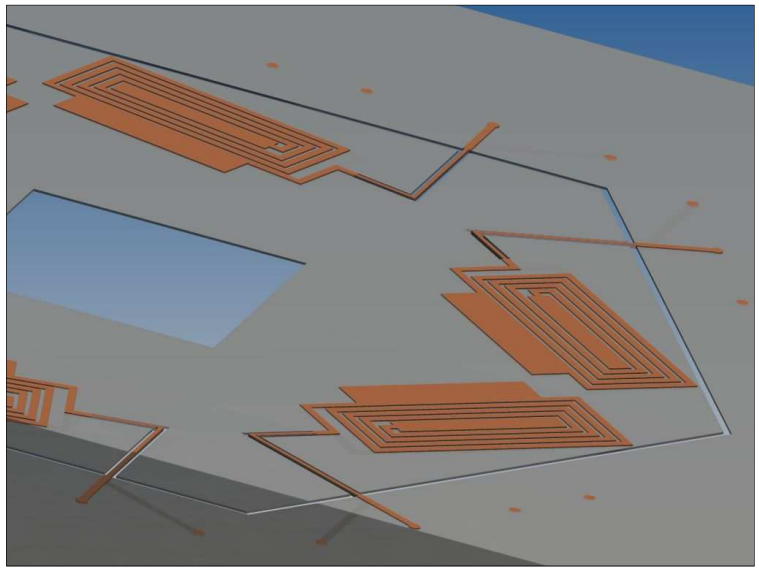
Active packaging in LTCC



Active packaging in LTCC



- **6 DOF design (10µm / 15º)**
- **Electrostatic / magnetic**



Converge Project

Iain McEwan, Heriot-Watt University

IMRC Conference

2010-07-02

Converge Overview

3 year project running Sept 09 to Sept 2012

Implemented to deliver Focus on Future aims

to bring together, develop and support business and technology

11 new team members recruited

Business Development, Enterprise Creation, and Corporate Communications

Aims:

Develop links between industry and academia through collaborative research

Develop new technology and to share our knowledge and expertise

To help businesses find innovative solutions to problems

Increase our ability to facilitate and share our research with Scottish, UK and global businesses

INNOVATION SUPPORT

Jim Shields, Innovation Specialist, Scottish Enterprise

JWI Conference – Digital Tools in High Value Manufacturing

July 2nd 2010

Scottish Enterprise Innovation Support.

- Support for Scottish companies of all sizes.
- Covering the entire spectrum of innovation.
- Help with developing novel PROCESSES and products.
- Innovation training and development of culture.

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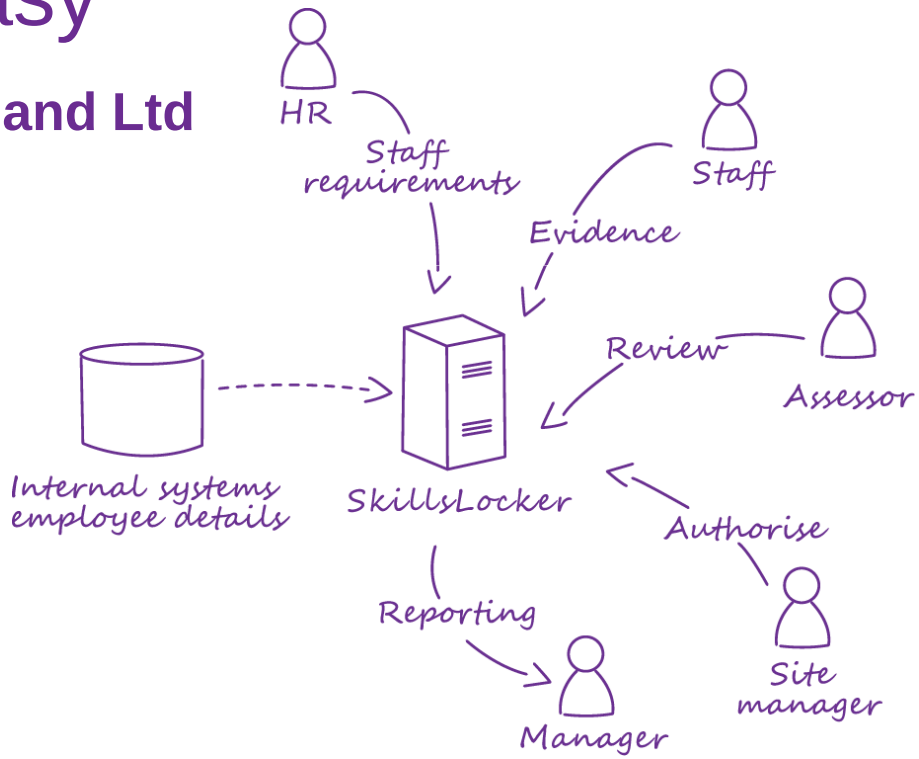
Competency Made Easy

Linda Steedman, MD eCom Scotland Ltd

Conference

2nd July 2010



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EPSRC Engineering and Physical Sciences Research Council

Competency Made Easy

Compliance made easy with Skillslocker

Meeting compliance with regulators has become an onerous task for many large manufacturing employers.

SkillsLocker was developed along with industry partners to make this compliance easy to manage.

In-depth analysis of the task was undertaken and iterative development methodologies applied to produce definable roles, reduce administration and build in flexibility.

Key influencers:

- **Changes to Directors Liability**
- **Availability of National Occupational Standards**
- **Acceptance of on-the-job training**

eCom Scotland

SkillsLocker™

Linda Steedman
Managing Director
e linda.steedman@ecomscotland.com
t +44(0)845 643 1344

PVCIT – A Product Evaluation and Digital Prototyping Centre of Excellence

Dr. Mark Williams, WMG, The University of Warwick

Event; Digital tools in High Value Manufacturing

Date; 2nd July 2010

PVCIT - A Product Evaluation and Digital Prototyping Centre of Excellence

Overview

PVCIT (*Premium Vehicle Customer Interface Technologies*) is a Centre of Excellence part funded by Advantage West Midlands (AWM) and the European Regional Development Fund (ERDF), and EPSRC (WIMRC) to provide support to industry based within the region.

The centre is a unique research and development facility that provides companies direct access to the latest product evaluation technologies and processes along with the expertise to identify solutions appropriate to real world engineering problems.

Along with our project partners, our aim is to build a facility that will stimulate the local economy and help to sustain the technical capability of the region.





Research

Advanced Metrology Systems – addresses the need for accurate, repeatable and relevant measurement for the delivery and manufacture of new products;

Design Review and Validation Technologies – addresses the efficiency of design review technologies and processes within product development, focussing on immersive visualisation and interaction with digital data;

Interaction with Vehicle Interiors – addresses the problem of growing complexity of driver controls and the influx of new technologies with which drivers must interact and focuses on optimising driver experience through an appropriate Human Machine Interface (HMI).

Facilities

4K 3D Powerwall – UK's highest resolution 10M Pixel projectors allowing photorealistic 1:1 scale visualisation;

Micro CT Scanner – 5µm high resolution capture of internal and external 3D geometry;

Laser Scanning – large scale, high accuracy and portable laser scanning technology with CMM and optical cameras;

Rapid Prototyping – wide range of RP technology including SLS,SLA, FDM and 3D printing.

Laser fabrication of 1D micro-optical components by localized vaporization and bumping

Krystian L. Wlodarczyk, Howard J. Baker, Denis R. Hall
Heriot-Watt University

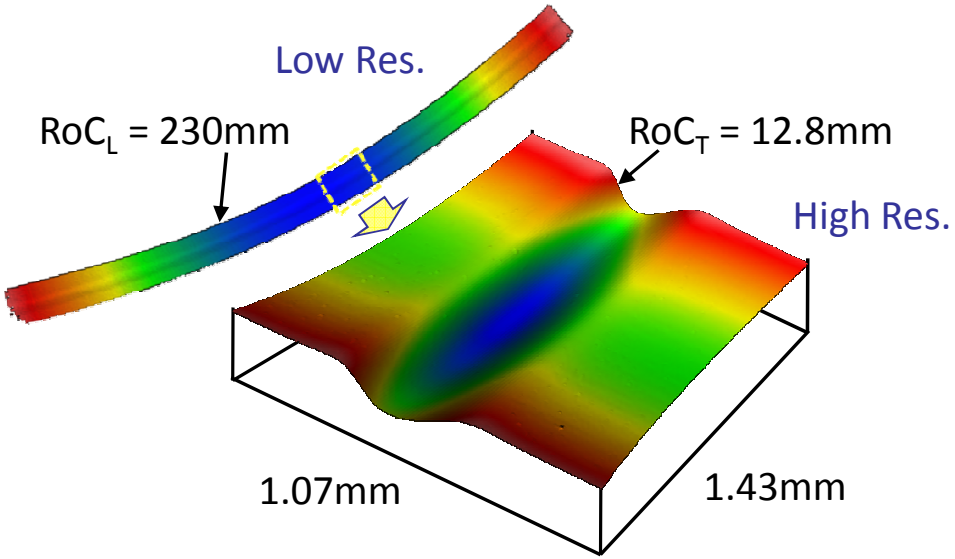
Digital Tools in High Value Manufacturing, IMRC Conference

2nd July 2010

Laser fabrication of 1D micro-optical components by localized vaporization and bumping

A new approach for the fabrication of sub-millimetre width cylindrical and toroidal mirrors in fused silica (HPFS 7980 Corning) using CO_2 laser polishing, but at laser powers which cause localized vaporization of glass rather than gentle surface melting.

Example: Zygo scans of 12.8mm RoC mirror



Key features:

- RoC$_T$ in the range from 2 to 30mm.
- Surface roughness measured along the mirror is < 5nm (pk-pk).
- Surface waviness generated due to fluctuations of laser power during the process is ~ 50nm (pk-pk).

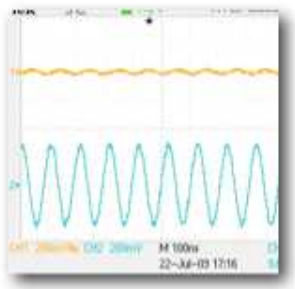
Successful application of the mirror as a peculiar resonator in a 400W, 150µm core Yb:YAG planar waveguide laser !

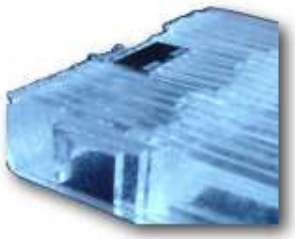
Batch of One - Avionics

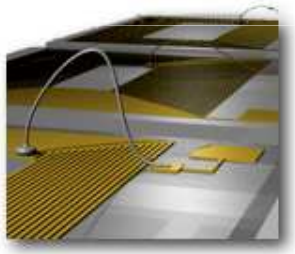
Jens Kaufmann, Ultra Electronics, Heriot Watt Univsity

2010 JWI Conference

July 2nd 2010







System Benchmarking

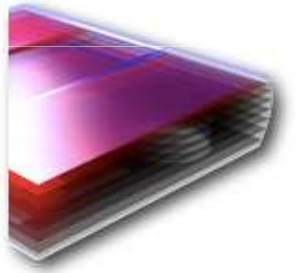
Manufacture Packaging

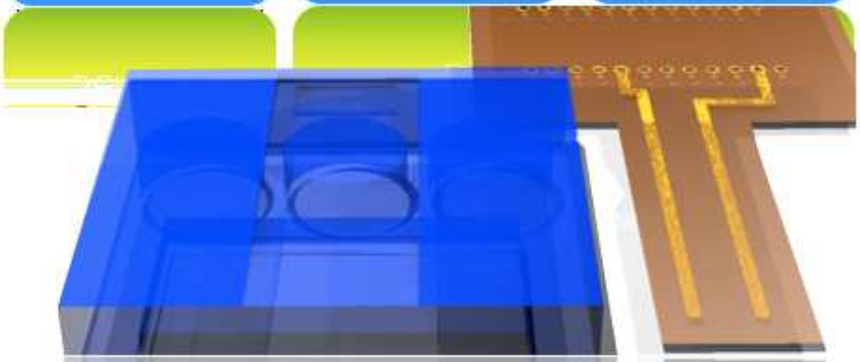
System Assembly

Generative Design Sensors

Generative Design Packaging

Automated Design for Manufacturing





FROM REQUIREMENTS TO PART IN 24H

Dopant Concentration Profiles in Barrier Slipcast YAG Ceramics for Side-Pumped Thin Slab Laser Materials

Aaron McKay, Victor Valles-Gomez, and Howard J. Baker,
Lasers & Photonic Applications group, Heriot-Watt University

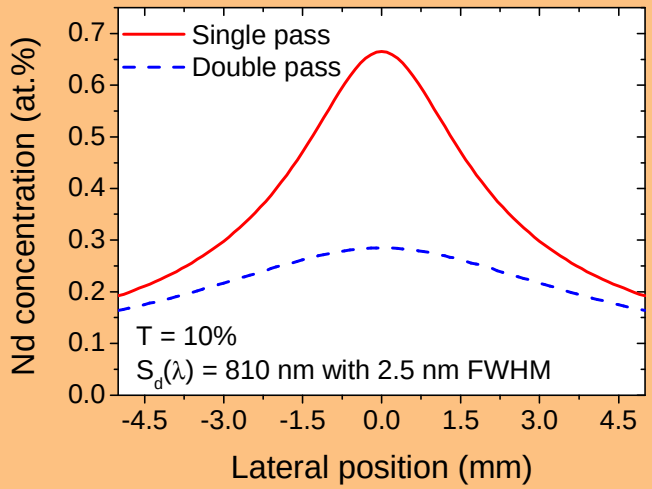
Heriot-Watt IMRC & James Watt Institute conference

2rd July 2010

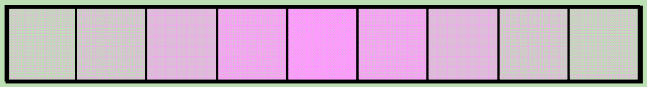
Dopant Concentration Profiles in Barrier Slipcast YAG Ceramics for Side-Pumped Thin Slab Laser Materials

Ideal concentration profile of thin slab-like laser materials for high-power solid-state lasers would possess **uniform gain**, no thermal lens and **improved pump efficiency**.

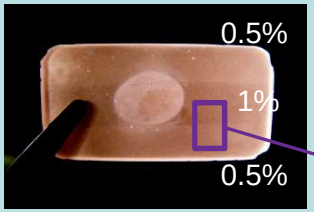
Optimal profile of a slab laser media

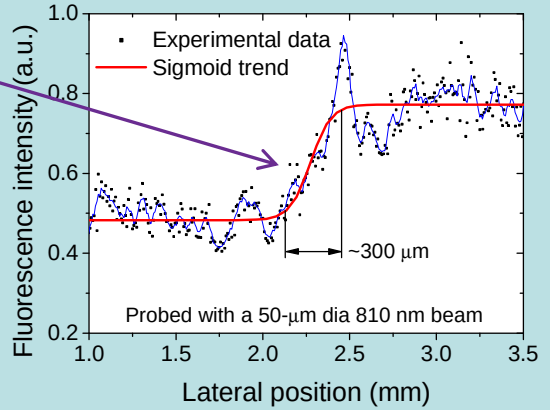


However, current techniques for laser gain materials with dopant profiles consist of bonding **sub-slabs of constant doping**



which is **expensive!**





- Pre-sintering concentration profile of a low-high dopant step boundary shows **significant intermixing**.
- Further **diffusion over many millimetres** is possible by adjusting the parameters of the sintering process.

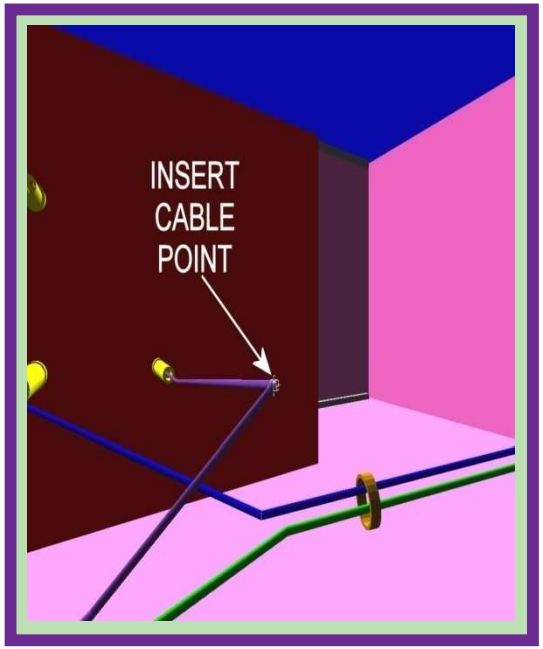
Automated Design Knowledge Capture and Representation in an Immersive Virtual Reality Environment

Raymond Sung, Dept. Of Mechanical Engineering, EPS

JWI Conference – Digital Tools in High Value Manufacturing

July 2nd 2010

Automated Design Knowledge Capture and Representation in an Immersive Virtual Reality Environment



- Design of cable assemblies using virtual reality
- Capture & representation of design knowledge
- Tools to train new users and to aid engineers in adhering to design rules

James Watt Institute for High Value Manufacturing

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Multimodal Presentation of Complex Surfaces

Thomas Methven, Texture Lab

Digital Tools in High Value Manufacturing

02/07/2010

IMRC Innovative Manufacturing Research Centres

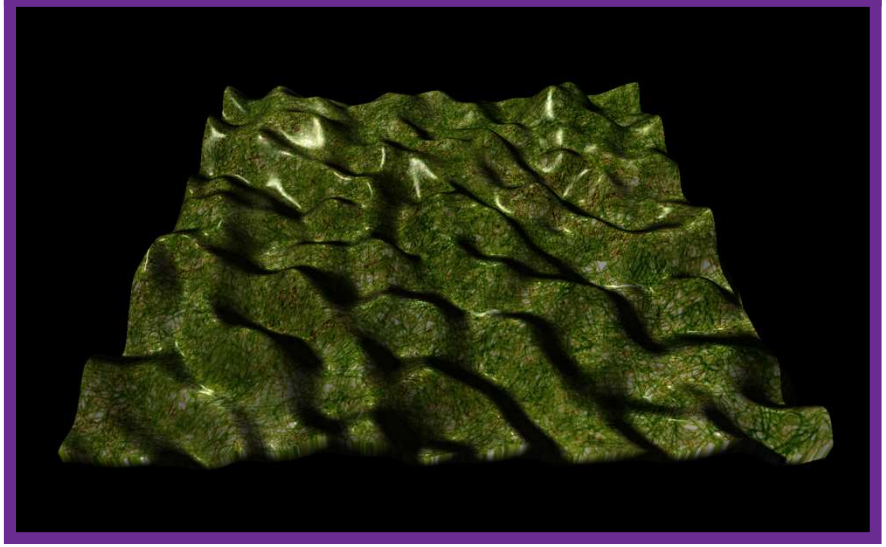
EPSRC Engineering and Physical Sciences Research Council

Multimodal Presentation of Complex Surfaces

Fabric Word Groups

- What words do naive observers use for fabrics?
- Which of these are the most important?
- How do we then communicate these digitally?

Real Time Stereoscopic Surfaces



The effect of Mesoscale Surface Roughness on Perceived Gloss

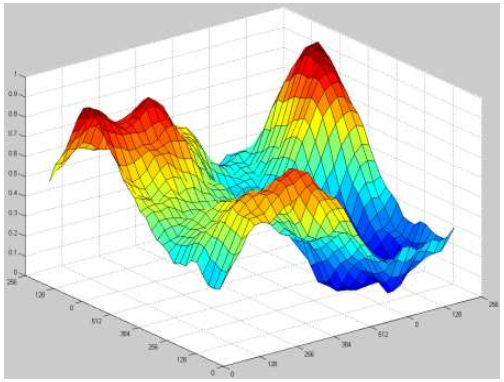
Lin Qi, Texture Lab

IMRC Conference

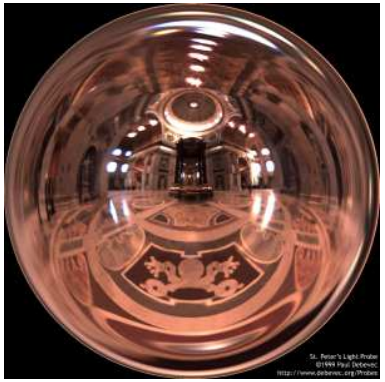
July 2, 2010

Stimuli from Physically Based Rendering

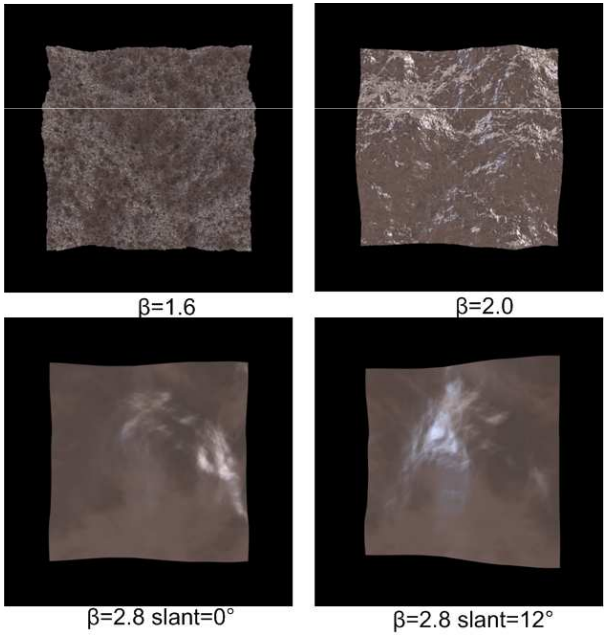
Random phase 1/f$^{\beta}$ noise surfaces were rendered in captured HDR environment to generate rotation animation stimuli.



Surface texture generating



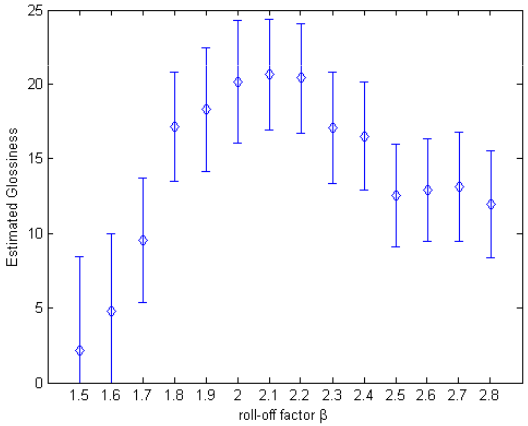
Illuminating

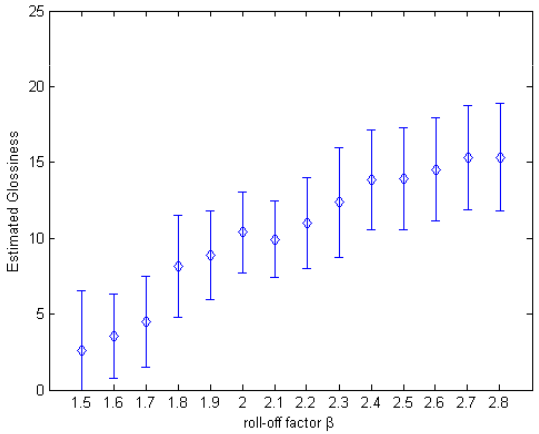


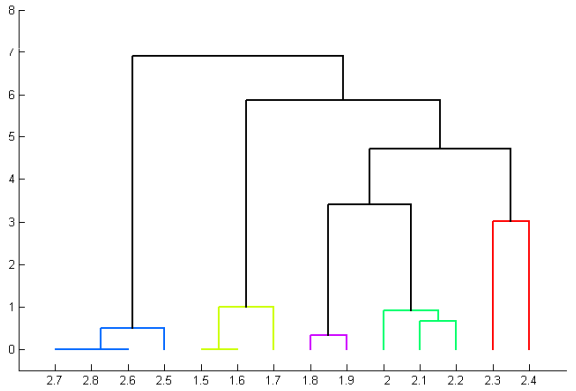
Rendering

How Surface Mesoscale Roughness Affects Perceived Gloss

Grouping and magnitude estimation experiments.







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Shoogleit: Interactive Web Representations

Dr. Stefano Padilla, Texture Lab

Digital Tools in High Value Manufacturing Conference

2nd July 2010

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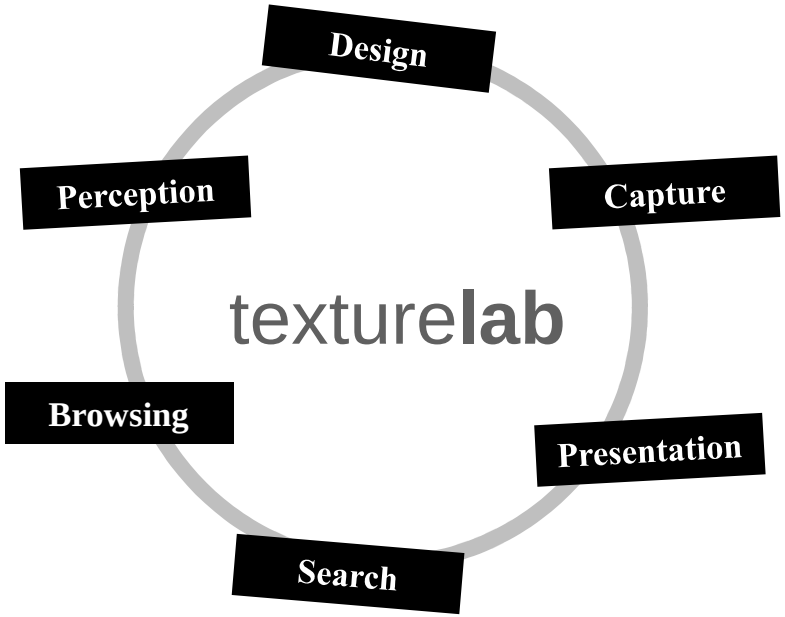
Shoogleit: Interactive Web Representations



- Show you some examples of interactive objects and surfaces running online.
- Demonstrate how can you add online interactions to your objects and create your own.
- Show you how can you easily distribute and embed them anywhere (facebook, blogs, etc)

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Interactive Presentation of Texture-rich Products on Handheld Devices

Pawel M. Orzechowki, Texture Lab

JWI Conference – Digital Tools in High Value Manufacturing

July 2nd 2010

IMRC Innovative Manufacturing Research Centres

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James Watt Institute for High Value Manufacturing

Interactive Presentation of Texture-rich Products on Handheld Devices

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SOMETHING TO EXPERIENCE

iPad demo of touchable textiles