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YU, Zeta (Tak For)

Objectives

To pursue a PhD degree on Bio-/Nano-Science or MEMS

Research Interests

Biomedical Engineering

- **DNA & Protein Analysis:** Molecular surgery, Genetic engineering, Regulation of gene expression, DNA micro-array, Protein identification & control
- **Biomedical/Chemical Systems:** Drug delivery system, Bio-sensor (tumor), DNA machinery
- **Applied Biology:** Stem cell control, Cloning, Neuro-engineering, Tissue engineering

NEMS

- **Nano-Fabrication & Characterization:** Self-assembly, Molecular manipulation, Top-down and Bottom-up fabrication, Application of quantum wire/dot
- **Nano-Scale Systems:** Nano-devices, Molecular machines

MEMS

- **Bio-MEMS:** Minimization of sophisticated bio-systems, Cell manipulation, Use of EP & DEP for separation
- **Fluidic MEMS:** Flow phenomena, Thermo-fluidic device

Research Experiences

Research Assistant: Supervised by *Prof. Yitshak ZOHAR* and *Prof. Yi-Kuen LEE*, Micromachine Laboratory, HKUST, Sept-2003 to Aug-2004

- Experimental (design, fabrication, and experiments) and computational (CFD) studies of
 - flow separations in microchannels with different flow features
 - flow in microchannels with multiple cavities and constrictions
 - branching microchannel systems
- Advisor for commercial software CFDRC in the Micromachine Laboratory
- Tutor of Final Year Project (FYP) students in MEMS: experiments and CFD

Research Assistant: Supervised by *Prof. Zohar*, Micromachine Laboratory, HKUST, July to Aug, 2001

- Design and fabrication of
 - micro-mixing devices for flow visualization, flow rate and pressure measurements
 - micro flow systems with cavities
- Tutored FYP students in MEMS: fabrications

Education

The Hong Kong University of Science and Technology (HKUST)

- *Master of Philosophy* in Mechanical Engineering, August-2003; GGA: 10, A- (12.0 scale)
- Master Thesis: “*Gas Flow in Microchannels with Cavities*,” 2003. Supervisor: *Prof. Zohar*. Worked in the Micromachine Laboratory.

- *Bachelor of Engineering* in Mechanical Engineering, Jul-2001; GGA: 10.73, A (12.0 scale)
- **First** in the **Graduating Class** (out of 104), **First Class Honors**;
- Final Year Project: “*Micromixing System*,” 2001. Supervisor: *Prof. Zohar*. Worked in the Micromachine Laboratory

Academic Awards

- **Dean's List** – Spring-2001; Fall-2000; Spring-2000; Fall-1999 & Fall-1998
- **Second Class Award**: Fabrication and characterization of micro-mixers. 7th National Challenge Cup, Xi'an, Sept-2001. Successfully visualized various flow interactions of argon gas and water in microdevices.

Scholarships

- Dow Hong Kong Scholarship, Feb-2001
- Simatelex Charitable Foundation Scholarship, Jan-2001
- Chen Hsong Industrial Scholarship, Jan-2000
- C. C. C. Kei Yuen College Scholarship, Sept-1998
- Postgraduate Studentship, 2001-03

Publications

- **Z. T. F. Yu**, Y. K. Lee, M. Wong, and Y. Zohar, "Fluid flows in microchannels with cavities," Submitted to *J. MEMS*.
- **Z. T. F. Yu**, Y. K. Lee, M. Wong, and Y. Zohar, "Size-dependent flow separation in microchannels with cavities," in *Proc. 17th IEEE Intl. Micro Electro Mechanical Systems Conf. (MEMS '04)*, Netherlands, 2004.
- S. Y. K. Lee, **Z. T. F. Yu**, M. Wong, and Y. Zohar, "Gas flow in a microdevice with a mixing layer configuration," *J. Micromech. Microeng.*, vol. 12, pp. 96-102, 2002.
- Y. Zohar, **Z. T. F. Yu**, and Y. K. Lee, "Hele-Shaw flow in a microchannel with cavities," in *Proc. 55th Ann. Meet. of the APS Div. of Fluid Dyn.*, Texas, 2002.
- **T. F. Yu**, S. Y. K. Lee, M. Wong, and Y. Zohar, "Instability modes of two-phase flows in a mixing-layer microdevice," in *Proc. 2001 ASME Intl. Mech. Eng. Cong. & Exp.*, New York, MEMS-23883, 2001.
- **T. F. Yu**, "Fabrication and characterization of micro-mixers," in *Proc. 7th National Challenge Cup*, Xi'an, 2001.

Experimental Skills & Instruments

- Liquid and 2-phase flow visualizations, Pressure and flow rate measurements
- Preparation and use of liquid crystal (LC), micro-particle, fluorescent dye/ μ -particle
- Pressure transducer, pressure calibrator, micro-positioner, syringe pump, high pressure gas bottle, precision pipette, ultrasonic bath
- 25fps CCD camera, Q-capture CCD system, high-speed camera, long distance microscope, video recorder, data acquisition system
- PTV (particle tracking velocimetry) & PIV (particle image velocimetry)
- Continuous flow liquid nitrogen cryostat: practice, operation & tool procurement
- Laser: practical experience with optical fiber
- Spin coater: procurement
- Microwave engineering: use for heating
- Stanford SR 830 DSP Lock-in amplifier, HP 214B Pulse generator
- Pfeiffer Turbo molecular vacuum pump: knowledge & operation
- LakeShore 331 Temperature controller: knowledge & operation
- Boiling and two-phase flow: practical knowledge
- DEP (dielectrophoresis): fundamentals & applications

Computational Fluid Dynamics & Software

- CFD-ACE+, CFDRC. An experienced user in solving problems of fluid flow in microchannels in different geometries (e.g. constriction, expansion and bend).
- LabView: use of GPIB for computer-instrument control
- Software: L-Edit, Adobe Premiere, Adobe Photoshop, Power Director (a movie editor), Paint Shop Pro, AutoCAD, Solidworks, C++, MATLAB and FORTRAN, Netscape Composer.

Teaching Experiences & Trainings

- *Teaching Assistant* (Fluid Mechanics): HKUST, Fall-2001
- *Teaching Assistant* (CAE): HKUST, Fall-2002
- *Tutor* for FYP students working in MEMS: HKUST, 2001-04
- "*Training Program for Teaching Assistants*": CELT, HKUST
- *Mathematics Tutor*: Parent-Teacher Association - Kei Yuen College, Jan to June, 2002
- Tutor*: for college students, 1994-2002

Trainings, Workshops & Classes

- Courses attended: *Cell Biology, Molecular Biology, Bioengineering Laboratory* (from cell culture, DNA-PCR to cell cloning), *Nanomaterials & Nanotechnology*.
- The Croucher Advanced Study Institute on “*Frontier Research on Nanomechanics*”, The University of Hong Kong, Feb-2004.
- *Advanced Microsystem Technology*, by Prof. Y.-K. Lee, HKUST, Fall-2002
- *Microelectronics Fabrication Technology*, by Prof. M. Wong, HKUST, Fall-2001
- *Introduction to Microsystems-Technology and Devices*, by Prof. Zohar, HKUST, Fall-2000
- “*MEMS Workshop*”, HKUST, Dec-1999

Languages

- English, German, Korean, Cantonese and Mandarin

Memberships

- ASME (The American Society of Mechanical Engineers): Student Member
- IEEE (Institute of Electrical and Electronics Engineers): Student Member
- APS (American Physical Society): Student Member

Fabrication Skills

Hand-on experience in designing, fabricating and operating microsystems

- Fabricated micro-devices in Microelectronics Fabrication Facility (MFF), HKUST:
 - micro-mixer: used surface micromachining to make channels for flow visualization
 - micro-cavity: used surface micromachining to make pressure sensors and channels
 - flow separation in microsystems: used DRIE to etch channel and inlet/outlet (through hole), and anodic bonding to package devices
- Clean room experience in MFF: 4 years
- **UCLA Nano-lab**: almost 20 modules trained

Mask: Laser-write chrome mask & transparency mask drawing by L-edit, Contact alignment, backside alignment

Thin film formation: Thermal oxide, LTO, PSG, low-stress nitride, poly-Si, PAH monomer, Al sputtering, UV curable polymer, PDMS, Parylene

Photolithography: Contact Aligner Karl Suss MA6, Contact Aligner AB-M (DUV, UV), thin to thick PR coating, PR patterning, SU-8

Etching: ICP DRIE, TMAH, BOE, conc. HF, O₂ plasma, dry/wet etching of oxide, nitride, poly-silicon, silicon, Photoresist, metal, etc.

Inspection: Profilometer, Nanospec, Scanning Electron Microscope (SEM)

Surface modification: Ion diffusion, implantation, densification, metal alloying, annealing

Packaging: Anodic bonding, PCB drawing and etching, Wire bonding

Processes: Sacrificial etching, lift-off process, surface micromachining, fabrication of pressure sensors and microchannels, release hole opening, contact window etching

Community Services

- *Master of Ceremonies*: 9th Congregation (School of Engineering) – HKUST, 7-Nov 2001
- *Ambassador*: HKUST 10th Anniversary Launching Ceremony, April-2001
- *Master of Ceremonies*: Xmas Dinner of the Graduate Students' Hall – HKUST, Dec-2001
- *Demonstrator*: Dept. of Mech. Eng. - Outreach Day of HKUST, 1998-2003
- *Financial Secretary*: Timothy Fellowship - L.T. Church (Y.L), 2000-2003
- *Mathematics Tutor*: Parent-Teacher Association - Kei Yuen College, Jan to June, 2002
- *Captain*: Road Safety Patrol, 1996-97; Leader: 94-95; Member: 91-94
- *Chairman*: Philatelic Club, Kei Yuen College, 1996-97
- *Staff*: Fellowship, Kei Yuen College, 1996-97

References

- Prof. Yitshak ZOHAR, Aerospace & Mechanical Engineering Department, University of Arizona, zohar@ame.arizona.edu
- Prof. Yi-Kuen LEE, Department of Mechanical Engineering, HKUST, meyklee@ust.hk
- Prof. Man WONG, Department of Electrical & Electronic Engineering, HKUST, eemwong@ee.ust.hk