Optical MEMS Laboratory - OML

Prof. Dr. Hakan Ürey

Koç University, Electrical Engineering
Koç University

Founded: 1993

7 faculties, 4 graduate institutes, 22 UG, 30 MS/MA, 15 PhD programs

256 Professoriate
235 Instructors

5,500 students
4650 UG, 500 MS/MA, 350 PhD

35 TÜBİTAK, 37 TÜBA Awards

57 FP7 Project; 34 Marie Curie, 25 Partnership; 3 ERC Projects

160 active projects 50 mn $

Times Higher Education (THE) Rankings
31st in THE Top 100-under-50 & Among top 300 in THE World Rank

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Research Focus:
MEMS, Micro-optics; 2D/3D Display and Imaging;

20+ Researchers:
1 faculty (Prof. Dr. Hakan Ürey, founder and director)
3 post-doctoral researchers,
4 Engineers,
1 Technician,
7 PhD students,
7 MS Students,
1 Admin. Assistant

mems.ku.edu.tr
Patent Success Story

Optical Microsystems Laboratory (OML)
Koç University

>25 Patents Filed or Issued in 10 years

17 Patents filed in which students are co-inventors

2 Spin-off companies

5 Companies licensed our patents
Laboratory Infrastructure

OML is well-equipped for electrical, optical, mechanical design, test, and characterization

Additional Lab Access: Cleanroom for Micro/Nanofabrication; KUYTAM Central Lab equipped with extensive characterization equipment
Infrastructure

OML is well-equipped for electrical, optical, mechanical design, test, and characterization.
Projects

- **Industrial Funding (>10 projects)**
  - Microvision (USA, since 2002), Aselsan (TR), Fraunhofer IPMS (DE), OPET (TR), Inventram (TR), Fotoniks (TR)

- **EC Funded Projects (7 projects)**
  - **ERC-Advanced** (2014-2019)
  - FP7 STREP projects (MEMFIS, HELIUM3D)
  - FP7 IAPP Project
  - FP6 Networks (NEMO, 3DTV, MINOS)

- **TÜBİTAK (8 projects)**
  - 5 projects completed
  - 3 projects on-going

- **3D displays** (3D laser TV, wearable displays, head-worn projection displays);
- **Pico-projectors and Laser scanners** (world leader in MEMS scanners);
- **Micro-optics** (head-up-displays, exit pupil expanders);
- **MEMS Spectrometers** (MEMS-based Fourier transform infrared spectrometer, Lamellar grating interferometers, FR4 based interferometers);
- **Thermal imaging** (MEMS based thermal detector array with optical readout; CMOS optical ROIC);
- **Portable Nano-Biosensor** (MEMS sensor array for multi-analyte screening for diagnostics applications).
Patents and Spin-Offs

• **Patent Licensing Agreements**
  *(consists a portfolio of about 25 patents)*
  – **Microvision Inc. (USA)**: MEMS and FR4 scanners, 3D displays, novel micro-optical screens
  – **Fraunhofer IPMS (DE)**: MEMS spectrometers
  – **Aselsan Inc. (TR)**: Thermal imaging sensor array
  – **Inventram Inc. (TR)**: Biosensors for point-of-care diagnostics of multiple diseases; 3D Contact lenses and glasses; External brain stimulator for neural diseases;
  – **Opet Inc. (TR)**: Tagging and identification of functional fluids

• **Spin-off companies from the lab**
  – Tarabios Inc. (bio-tech)
  – Quantag Inc. (energy)
Display Related Projects:

- Wearable Display
- Pico-projectors
- Eyewear displays
- 3D Picop
- Dynamic Pupil Tracker
- 3D HMPD
- AR Bidirectional Screens
- Multi-viewer 3D
- 3D Telepresence

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• Received ERC-Advanced Grant
• 2.5MEuro for 5 yrs (Started Jan 2014)
• Objectives: develop novel wearable displays with extremely large FOV and exceptional 3D capabilities
OML Research on MEMS Laser Scanners for Displays and Imaging

- **Electromagnetic, MEMS**
  Yalcinkaya, JMEMS, 2006

- **Electrostatic MEMS**
  Arslan, JMEMS, 2010

- **Piezoelectric, MEMS**
  Baran, JMEMS, 2012

- **Rotary Electrostatic, MEMS**
  Baran, JMEMS, 2012

- **Microlens array on 2D MEMS Stage**
  Gokce, JMEMS, 2010

- **Thin Film Magnetic, FR4**

- **Integrated Electromagnetic, FR4**
Biosensors for POC Diagnostics:
Immunosassay, Viscosity & Coagulation Tests

Timurدوگان et al, Biosens & Bioelec, 2011
Cakmak et al, Methods, 2013
Thermal Imaging Using Thermo-Mechanical Pixels and Optical Readout

Sensor Input

Array (35um and 50um pixel sizes)

MEMS/CMOS Integration

Image and video acquisition using discrete optics

Single pixel

1st order

0th order
OML Research on MEMS FT Spectrometers

FP7-Strep Project: MEMFIS
Partners: Bruker, KOC, FhG-IPMS, VIGO, SOPRALAB, CTR, Teknikon

Summary

Collaboration Opportunities within Horizon 2020:

• Areas of interest: photonics, MEMS, and human-computer interaction

• Photonics KET2014, suitable topics:
  – Biophotonics for screening of diseases
  – Sensing for safety and security

• FET-Open projects

Positions at OML:
Several PhD and Post-doctoral positions available.

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