

Feroz Ahmed

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Portfolio: <https://github.com/ferozkuetupc/>
Google Scholar:
[/citations?user=KXQCEEMAAAAJ&hl=en](https://scholar.google.com/citations?user=KXQCEEMAAAAJ&hl=en)

EDUCATION

Okayama University Okayama, Japan
Ph.D. in Medical Bioengineering March 2021
Thesis: Visualization of interaction of solutions through microfluidic chips using Terahertz technology
URL: <https://ousar.lib.okayama-u.ac.jp/ja/62159>
Polytechnic University of Catalonia Barcelona, Spain
Master in Photonics September 2013
Thesis: Robust Modular Optical Biosensors
URL: <https://upcommons.upc.edu/handle/2099.1/19033>
Khulna University of Engineering and Technology Khulna, Bangladesh
Bachelor of Science (B.Sc.) in Electrical and Electronic engineering March 2007
Thesis: An Automatic speaker recognition system

RESEARCH INTERESTS

Laser sensing, imaging and spectroscopy, non-linear optics, molecular dynamics, microfluidics, micro and nano fabrication, fluid dynamics, optical bio-sensing, electro-chemistry, machine learning.

JOB EXPERIENCE

Researcher, University of Tsukuba Tsukuba, Japan
Faculty of Pure and Applied Sciences, Department of Applied Physics Oct. 2022– present
Responsibilities: Applying THz laser spectroscopy for the analysis of chemical and biological samples from molecular dynamics, Collaboration with SHISEIDO company Ltd., Japan
Researcher, Okayama University Okayama, Japan
Faculty of Interdisciplinary Science and Engg. in Health Systems May 2021– Mar. 2022
Responsibilities: Microfluidic chip fabrication, Terahertz laser imaging and spectroscopy, THz chemical microscopy.
Plant and Consultant Engineer Barcelona, Spain
Hi-VAN Bangladesh Ltd., jointly work with Sitecno, Barcelona, Spain Jan. 2015– Sep. 2017
Responsibilities: Feasibility study on and off-grid project sites in Bangladesh, On-grid and off-grid photo-voltaic solar cells installation
Lecturer Dhaka, Bangladesh
Prime University, Dept. of Electrical and Electronic Engg. Apr. 2008– Sep. 2012
Responsibilities: Delivered lectures on electrical engineering and electronics courses. Conducted laboratory experiments on electronics, electrical machines. Attended international and national symposiums for research and development.
Site Supervising Engineer Dhaka, Bangladesh
TecPro Tele Engineering Ltd., A Telecom sub-vendor Oct. 2007– Apr. 2008
Responsibilities: Site commissioning and installation of BTS in GSM/WIMAX network with vendor Ericsson, HUAWEI. Site investigation for base transceiver station (BTS) installation and dismantling of telecom equipment. Familiar with site survey telecom tool. Acquired knowledge on RF planning and optimization.

AWARDS AND SCHOLARSHIPS

- Research scholarship of Otsuka Scholarship Foundation, Osaka from 2018-2019.
- University merit scholarship for good academic results in junior year of B.Sc., 2005.
- National Borad Merit Scholarship for excellent academic results in senior school education, 2001.

TECHNICAL SKILLS

Programming: ANSYS Fluent, SolidWorks, C, Python (beginner), L^AT_EX; Scientific Computing Environment: LabVIEW

PUBLICATIONS

- [1] **Feroz Ahmed***, Masashi Shimizu, Jin Wang, Kenji Sakai, and Toshihiko Kiwa. Optimization of microchannels and application of basic activation functions of deep neural network for accuracy analysis of microfluidic parameter data. (* correspondence) *Micromachines*, 13(8):1352, 2022.
- [2] **Feroz Ahmed***, Yuichi Yoshida, Jin Wang, Kenji Sakai, and Toshihiko Kiwa. Design and validation of microfluidic parameters of a microfluidic chip using fluid dynamics. (* correspondence) *AIP Advances*, 11(7):075224, 2021.
- [3] **Feroz Ahmed***, Atsuya Mahana, Katsuya Taniizumi, Jin Wang, Kenji Sakai, and Toshihiko Kiwa*. Terahertz imaging technique for monitoring the flow of buffer solutions at different ph values through a microfluidic chip. (* correspondence) *Japanese Journal of Applied Physics*, 60(2):027003, 2021.

- [4] **Feroz Ahmed**, Tatsuki Kamiya, Yuki Maeno, Toshihiko Kiwa, Kenji Sakai, and Keiji Tsukada. Improvement of contrast of terahertz images of a terahertz chemical microscopy using adaptive digital filter. In *2019 International Conference on Computer, Communication, Chemical, Materials and Electronic Engineering (IC4ME2)*, pages 1–4, 2019.
- [5] P Chakraborty, **Ahmed, F**, Md Kabir, Md Shahjahan, Kazuyuki Murase, et al. An automatic speaker recognition system. In *2007 14th International Conference on Neural Information Processing*, pages 517–526. Springer, 2007.
- [6] Mohammad Rokonzaman, SM Ferdous, Sayedus Salehin, SMAA Hasnine, and **Ahmed, Feroz**. Smooth track-keeping and real time obstacle detection algorithm with pid controller for a wheeled line following robot. In *2010 International Conference on Mechanical, Industrial and Energy Engineering, Khulna, Bangladesh. 23-24 December, 2010*, pages 1–6, 2010.

INVITED TALKS

- Feroz Ahmed, Atsuya Mana, Katsuya Taniizumi, Jin Wang, Kenji Sakai, Toshihiko Kiwa. THz technology applied in Microfluidics with lifesaving analysis in health industry. (Invited Talk via Webinar. Dhaka, Bangladesh. Oct.7, 2021). 2021 Online Webinar hosted by Faculty of Engineering, American International University of Bangladesh (AIUB), Dhaka, Bangladesh.
- Feroz Ahmed, Atsuya Mana, Katsuya Taniizumi, Jin Wang Kenji Sakai, Toshihiko Kiwa. Analysis of the interaction of multi-phases flow of fluids through internal micro flow channels of a microfluidic chip using THz image sensing technology. (Invited Online Oral Presentation). Changchun, China. Sep. 14-16,2021. 2021 Online International Conference on the Corporation and Integration of Industry, Education, Research and Application.
- Feroz Ahmed, Atsuya Mahana, Katsuya Taniizumi, Kenji Sakai, Toshihiko Kiwa. Monitoring of Different pH Buffer Solutions' Interaction in Micro Flow Channels Fabricated by PolyDiMethylSiloxane (PDMS) (Online Conference). Tokyo, Japan. Sep. 8-11, 2020. 81st JSAP-OSA Joint Symposium, September 8-11, 2020.
- Feroz Ahmed, Tatsuki Kamiya, Yuki Maeno, Toshihiko Kiwa, Kenji Sakai and Keiji Tsukada. Improvement of contrast of Terahertz Images of a Terahertz Chemical Microscopy using Adaptive Digital Filter and its applications in Biomedical engineering (Invited talk). Dhaka, Bangladesh. Jul. 13, 2019. Ahsanullah University of Science and Technology (AUST), Dhaka, Bangladesh.
- Toshihiko Kiwa, Yuki Maeno, Atsuya Mana, Feroz Ahmed, Kenji Sakai, Keiji Tsukada. Measurement of ion concentration in minute solution by terahertz wave chemical microscope (Invited talk). KitaKyushu, Japan. May. 18-19, 2019. 79th Analytical Chemistry Discussion Meeting 18-19 May, 2019.

POSTER PRESENTATION

- F. Ahmed, N. Darwish, F. Palacio-Bonet, M.A. Giménez-Conejo, I. Bernat-Ubiaga, A. Romano-Rodríguez, M. Moreno-Sereno, Department of Electronics, Universitat de Barcelona, C/Marti i Franquès 1, 08028 Barcelona. Instrumentation for a Multichannel Optical Waveguide Lightwave Spectroscopy. Optical and X-Ray Metrologies of key enabling Nanomaterials/devices for the Ubiquitous Society, Renewable energy and Health (OptoX-NANO), Okayama Convention Center, Okayama, Japan, 19-23 November 2017.
- Yuki Maeno, Atsuya Mahana, Feroz Ahmed, Toshihiko Kiwa, Kenji Sakai, Keiji Tsukada. Detection of ions in solutions without a reference electrode using a Terahertz Chemical Microscope. Busan. The 5th International Symposium on Microwave/Terahertz Science and Applications, MTSA2019, 29 Sep.-3 Oct. 2019, Busan, Korea, Mo-POS-29.
- Yuki Maeno, Atsuya Mahana, Feroz Ahmed, Toshihiko Kiwa, Kenji Sakai, Keiji Tsukada. Fabricating micro wells for measurement of ions in solutions using a Terahertz Chemical Microscope. Optical and X-Ray Metrologies of key enabling Nanomaterials/devices for the Ubiquitous Society, Renewable energy and Health (OptoX-NANO), Okayama convention center, Okayama, Japan, 02-05 December 2019.

REVIEWER ROLE IN THE JOURNALS

- Reviewer of APL machine learning Journal, AIP Publishing, USA. Title: Amplitude/Phase Retrieval for Terahertz Holography with Supervised and Unsupervised Physics-Informed Deep Learning. manuscript reviewed. 22 March 2022.
- Reviewer of Bio-microfluidics Journal, USA. Title: On-chip dielectrophoretic device for cancer cell manipulation: A numerical and artificial neural network study. Nov. 2022. & Feb. 2023
- Reviewer of IEEE transactions on NanoBioscience, USA. Title: Design and Analysis of Multi-Analyte Detection-based Biosensor in the Visible to Near-Infrared (VNIR) Region. Dec. 2022.
- Reviewer of American Journal of Applied Physics, AIP Publishing, USA. Title: Suitability of metallic materials for constructing metal-coated dielectric terahertz waveguides. Manuscript reviewed on July 2021.
<https://orcid.org/0000-0003-2517-072X>

- Present Work summary included in the manuscript: "Study of molecular dynamics of glycerol-water mixture, and PEG/PPG-m/n dimethyl ether, polyquaternium-51 polymers solutions using THz-time domain spectroscopy. Yiru Zhang, Feroz Ahmed, Makito Suzuki, Makiko Goto, Mariko Egawa, and Toshiaki Hattori." Royal Society of Chemistry, Sensors and Diagnostics. Equal contribution work with first author.
Abstract: Hydrogen bonding properties of water molecules are confined in microcavities of biological interfaces, which are remarkably dissimilar from those of bulk water with the abilities to drive the most of biological processes. Terahertz (THz) time-domain spectroscopy (TDS) technique can probe the collective dynamics of hydrogen bonds in the hydration layer to describe the dynamics of the thick (20–40 Å) sheath of hydration layer around biological molecules, which can control all important functions of those molecules in life. We investigated the absorption co-efficient profile variation as the function of different THz frequencies and concentrations of glycerol-water mixtures. Besides, we calculated the number of hydration water per glycerol molecules and di-electric strength as a function of different concentrations of glycerol-water mixture samples from the dynamics of bound water, which range from 0.8 to 1.1 THz frequency spectra. In another study, we analyzed the frequency and concentration dependence of increased absorption coefficients at low concentration level with the decreased nature at mid to high concentration values, and refractive indices of PEG/PPG-m/n dimethyl ether and Polyquaternium-51 which showed notable results for the quality-based cosmetics productions.

DETAILED DESCRIPTIONS OF PAST RESEARCH EXPERIENCES

- Summary of PhD works : Terahertz wave is a generic term for electromagnetic waves containing frequency components from 100 gigahertz to 10 terahertz. In recent years, the generation and detection of terahertz waves has become easier. This is a frequency band that has become easy to generate and detect in recent years, and various applications are being actively explored in this field. In this thesis, terahertz wave chemical microscopy, one of the terahertz wave technologies, is applied as a visualization technique for solution interaction in microfluidic channels. This thesis describes the application of terahertz wave chemical microscopy, one of the terahertz wave technologies, to the visualization of solution interaction in microfluidic channels. For efficient device operation, observation of the solution flowing in the microfluidic channel is required. The main results of this thesis are: 1. visualization of laminar flow in microfluidic channels by terahertz wave chemical microscopy, 2. Improvement of contrast and visualization speed of terahertz wave images by applying adaptive digital filters, 3. Simplified analysis of dynamics in microfluidic channels using an equivalent circuit model. These results provide an important basic technology for observing and precisely controlling solutions flowing in microfluidic channels in the future. These results are expected to make a significant contribution to the application of terahertz wave technology and to the field of fluidic devices such as microfluidic channels.
- Masters work Summary: Optical Waveguide Light Spectroscopy (OWLS)- a label-free technique applied for optical bio-sensing. It is based on the coupling of laser light in an optical waveguide through a Diffraction Grating (DG) fabricated on the surface. The coupling angle is related to the instantaneous refractive index or thickness of a bio-layer growing over the DG. An optical grating coupler biosensor (OGCB) is based on a diffraction grating patterned on the surface of a waveguide. When the light is incident at a specific or resonant angle on the grating, the light can couple into the thin optical waveguide. The coupled light can be detected at the end of the waveguide with a photodiode. This technique is also known as OWLS. For reading simultaneously the multiple out-coupled laser beams in the edge of the sensor, photodetector arrays were used. For this purpose, we designed an electronic board and electronic control of a commercial array of 512 photo-detectors with a microcontroller. The array was used for monitoring the output of multiple laser beams from the edge of an optical grating waveguide sensor. Data from the array were transferred using a USB cable to a personal computer for drawing and processing. By using the physics of a diffraction grating, OGCB measured the concentration of an analyte by detecting changes in the angle at which light couples into a waveguide. Biological receptors on the surface of the waveguide captured the molecules of interest, which affected the bio-layer's thickness and refractive index seen by the evanescent wave. For measuring different bio-analyte solutions, different flow cells are used in the micro-fluidics of (OGCB) Optical Grating Coupler Biosensor (flow cells for injecting different bio-analyte solutions to measure concentration in Bio-medical Engineering applications). We achieved sensitivity of 8.77^o/RIU. Different types of bio-analytes like glucose, protein, enzyme, pH buffer solutions of acid, base based, glycerin etc. with different refractive indices show distinct response to our developed prototype optical biosensor.
- Artificial Intelligence (AI) applied Microfluidics work: Micro flow channels of height of 100 μm have designed, drafted and printed to prepare replica mold of a PolyDiMethylSiloxane (PDMS)-made microfluidic chip for performing the experimental measurement. At a time, three-dimensional simulation was performed to realize the particles' distribution of fluids inside the micro flow channels with the presentation of concentration profiles of individual regions of internal channels paths (e.g., outlet surrounded region; two fluids flow interactive common channel path etc.). Using more than 1600 experimental and the interpolation of data, deep Learning (DL) algorithm (dense layers of rectified linear unit) was applied to find the exact instantaneous input values (at two inlet wells of the designed microfluidic chip) corresponding to output values through the outlet well of micro flow channels of a microfluidic chip. This results indicate the future vast amount of data analysis in the field of microfluidics using AI.