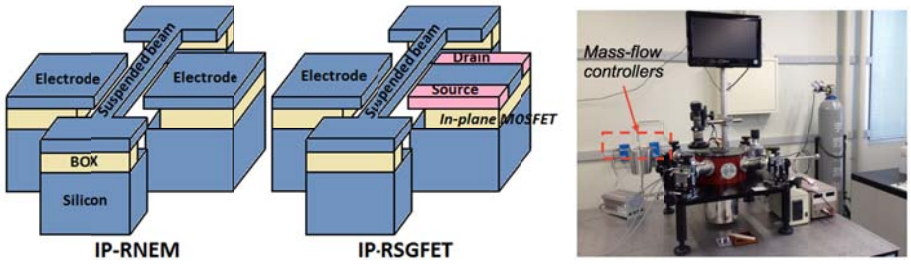
Research institution: Japan Advanced Institute of Science and Technology (JAIST), School of Materials Science, **Host researcher:** Prof. Hiroshi Mizuta

Micro/nano-electro-mechanical systems (MEMS/NEMS) has been the main area of my research since my master degree. My PhD research has focused on newly-proposed in-plane resonant NEM sensors based on mass-detection principle. The in-plane resonant NEM (IP-RNEM) sensor (Fig. 1 (a)) is a nano-scale suspended silicon beam with two side electrodes. The suspended beam is later co-integrated with an in-plane MOSFET to realize the in-plane resonant suspended field-effect-transistor (IP-RSGFET) sensor (Fig. 1 (b)). The proposed NEM sensors will be used for the detection of biological/chemical molecules. The design, simulation, fabrication and the characterization of the sensors before the functionalization and detection processes were conducted during my PhD at the University of Southampton, United Kingdom.

My short-term JSPS fellowship at the laboratory of the host researcher, Prof. Hiroshi Mizuta, was focused on the measurement of the sensor after the functionalization and detection processes. A unique NEM sensor measurement system is available at the laboratory of the host researcher that has the capability of inserting CO_2 and N_2 gases to the chamber using the newly-installed mass-flow controllers (Fig. 1 (c)). Except from the previously mentioned mass-detection method for sensing the adsorbed molecules onto the surface of the beam, conductance-detection is another sensing method. The conductance detections for the suspended beam before and after the functionalization and in the presence of CO_2 and N_2 gases were done. Further analysis on the results of the RF characterization of the IP-RNEM sensor has been done. I have used Amsterdam Density Functional (ADF) computational chemistry package that is available at the laboratory of the host researcher to investigate the effect of adsorption of molecules on the electrical characteristics of the suspended beam. This package can be used for atomic layer materials such as graphene as well as bulk silicon.

I am very thankful to JSPS and my host researcher for providing the unique and valuable opportunity of conducting research in Japan, the home of culture and technology.



(a) (b) (c)

Fig. (a) The schematic view for: (a) IP-RNEM and (b) IP-RSGFET sensors, (c) the measurement setup at the laboratory of host researcher at JAIST

Current position: Researcher at Japan Advanced Institute of Science and Technology, School of Materials Science, **E-mail:** ahfaezeh@jaist.ac.jp