

# 2023년 한국전자파학회 동계종합학술대회

## 기조강연

일자 2023년 2월 16일(목)

장소 그랜드볼룸 A, B, C

시간	발표제목	발표자
13:40~14:10	국방 R&D의 미래	김태곤 첨단기술사업단장 (방위사업청)
14:10~14:40	Microwave Water Cut Sensors for Oil Industry: From Design to Deployment in the Field	Prof. Atif Shamim (KAUST, IEEE Distinguished Lecturer)

### 기조강연 1



#### 국방 R&D의 미래

김태곤 첨단기술사업단장 (방위사업청)

국방기술개발 예산은 2013년 6,468억원에서 2023년 2조7176억원으로 10년 간 4배 이상 성장하였다. 그러나 국방기술개발은 예산 규모만 양적으로 성장한 것이 아니라, 다양한 기술개발 형태와 군의 전력화 시점에 대응하기 위해 기존의 핵심기술개발사업에 더해 신속연구개발사업, 미래도전사업 등 새로운 사업을 신설하고 제도를 개선하는 질적 개선도 추구하였다.

이는 과거 국방연구개발이 국가가 주도하고, 국방과학연구소와 방산업체 위주로 폐쇄적으로 진행되었다는 비판을 극복하고, 민간 영역과의 협업을 장려하는 개방적 R&D로 전환하기 위한 큰 흐름이다.

4차 산업혁명을 맞이하여 빨라진 기술개발 속도와 병력자원 감소, 전세계적 기술패권경쟁에 대응하기 위해서는 군의 소요제기를 기다린 뒤 기술을 개발하는 형태의 연구개발보다는 선제적으로 전쟁 패러다임을 전환할 수 있는 미래형 국방기술을 개발하고, 이러한 기술이 소요를 창출하는 tech-push형 연구개발이 중요해졌다.

미래도전국방기술개발사업은 이러한 기술개발 수요에 대응하기 위해 2019년 신설되었으며, 주요 연구개발 영역으로는 정찰 및 통신용 초소형 위성, 극초음속 비행체, 레이저 무기체계, 유·무인복합 무기체계 등이 있다. 이를 통해 수직·수평적 확장, 전투주체의 무인화, 기존 무기체계의 한계 돌파 등 미래 전장을 주도하기 위한 국방기술을 선제적으로 확보하고 있다.

- 방사청 방위사업정책국장
- 방사청지휘통제통신사업부장
- 방사청 기획조정관
- 방사청전자전사업팀장
- 국제전략문제연구소(CSIS) 파견
- 방사청 수출진흥과장

### 기조강연 2



#### Microwave Water Cut Sensors for Oil Industry: From Design to Deployment in the Field

Prof. Atif Shamim (KAUST, IEEE Distinguished Lecturer)

Modern reservoir management in oil and gas industry relies on accurate water fraction measurement which is produced as a by-product with oil. The water-cut sensors available at the moment are either costly, heavy, intrusive, incapable of covering full water-cut range and/or require mixer as a flow conditioner. In this talk, we present inline, pipe conformable microwave resonator-based sensor which is capable of detecting full range (0-100%) water cut. First, a basic microwave resonator-based water cut sensor will be presented which is implemented in a curved fashion on a pipe surface. To realize the sensor on the pipe, a concept of dual ground plane will be introduced. Later in this talk, an advanced design will be presented which can operate consistently on horizontal or vertical pipe sections, negating the effect of either orientation of the pipe or oil-water mixture flow regime on sensor's performance. A compact downhole version of the sensor is also presented. This talk will also describe realization of the sensor through low cost screen printing process, and its characterization in an industrial flow loop test setup that emulates oil field conditions. Finally, all the steps required to transform a lab prototype (TRL 2-3) into a field deployable product (TRL7-8) will be explained. Field test results and challenges of measuring the water fraction in presence of gas will conclude this talk.

**Atif Shamim** - received his MS and PhD degrees in electrical engineering from Carleton University, Canada in 2004 and 2009 respectively. He was an NSERC Alexander Graham Bell Graduate scholar at Carleton University from 2007 till 2009 and an NSERC postdoctoral Fellow in 2009-2010 at Royal Military College Canada and KAUST. In August 2010, he joined the Electrical and Computer Engineering Program at KAUST, where he is currently an Associate Professor and principal investigator of IMPACT Lab. He was an invited researcher at the VTT Micro-Modules Research Center (Oulu, Finland) in 2006. His research work has won best paper awards in IEEE ICMAC 2021, IEEE IMS 2016, IEEE MECAP 2016, IEEE EuWIT 2008, first prize in IEEE IMS 2019 3MT competition and IEEE AP-S Design Competition 2022, finalist/honorable mention prizes in IEEE AP-S Design Competition 2020, IEEE IMS 2017 (3MT competition), IEEE IMS 2014, IEEE APS 2005. He has been selected as the Distinguished Lecturer for IEEE AP-S (2022-2024). He has won the Kings Prize for the best innovation of the year (2018) for his work on sensors for the oil industry. He was given the Ottawa Centre of Research Innovation (OCRI) Researcher of the Year Award in 2008 in Canada. His work on Wireless Dosimeter won the ITAC SMC Award at Canadian Microelectronics Corporation TEXPO in 2007. Prof. Shamim also won numerous business-related awards, including 1st prize in Canada's national business plan competition and was awarded OCRI Entrepreneur of the year award in 2010. He is an author/co-author of around 300 international publications, an inventor on more than 40 patents and has given close to 100 invited talks at various international forums. His research interests are in innovative antenna designs and their integration strategies with circuits and sensors for flexible and wearable wireless sensing systems through a combination of CMOS and additive manufacturing technologies. He founded the first IEEE AP/MTT chapter in Saudi Arabia (2013) and served on the editorial board of IEEE Transactions on Antennas and Propagation (2013-2019), and as a Guest Editor for IEEE AWPL Special issue (2019), and is currently serving as an Associate Editor for IEEE Journal of Electromagnetics, RF and Microwaves in Medicine and Biology. He serves on numerous IEEE committees such as IEEE Technical committees on Antenna Measurements (AP-S), Microwave Controls (MTT-S 13), and Additive Manufacturing (CRFID). Find out more details at (<https://cemse.kaust.edu.sa/impact>)