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HIGH FREQUENCY SURFACE WAVE RADARS & INTEGRATED SURVEILLANCE SYSTEMS

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ABSTRACT

Countries with substantial coastal regions require greatly enhanced systems to monitor activity occurring within their Exclusive Economic Zones (EEZ). According to the United Nations Conven-tion on the Law of the Sea (UNCLOS) of 1992, participating countries have extensive exploitation rights within the EEZ, which extends up to 200 nautical miles (nm) from shore. Activity will in-clude isolated or grouped, moving and/or anchored surface targets and low-flying aircraft. The targets may be military/commercial, friend/foe, small/large. Besides the economic benefits, a par-ticipating country carries responsibilities such as prevention of smuggling, terrorism and piracy; the effective management and protection of offshore fisheries; search and rescue, vessel traffic services, pollutant control as well as meteorological and oceanographic data collection.

Traditional land-based microwave radars are limited to line-of-sight, which means a maximum range of 50-60km even with an elevated radar platform. The EEZ can be covered by microwave radar in a patrol aircraft but requires three to five aircraft (well above 20,000ft) with many hours on station. Satellites have neither the spatial nor the temporal resolution to provide this surveil-lance in real-time. Sky wave high frequency (HF) radars can be used for this purpose, but they need large installations, are expensive and detection of surface targets is still limited. Optimum sensor for EEZ surveillance seems to be the Surface Wave HF radar.

This DL/Keynote talk is about modeling and simulation strategies and challenges in integrated maritime surveillance systems based on High Frequency Surface Wave Radars (HFSWR). Topics to be covered include fundamental radar concepts, HFSWR signal characteristics (signal, noise, clutter, interference, etc.), Surface wave propagation modeling and mixed-path effects, Transmit/Receive Antenna systems and beam forming/steering, Target reflectivity and RCS prediction/reduction, and Stochastic modeling.

BIO

Dr. Levent Sevgi is a Fellow of the IEEE (since 2009) and the recipient of IEEE APS Chen-To Tai Distinguished Educator Award (2021). He was with Istanbul Technical University (1991–1998), TUBITAK-MRC, Information Technologies Research Institute (1999–2000), Weber Research Institute / NY Polytechnic University (1988–1990), Scientific Research Group of Raytheon Systems Canada (1998 – 1999), Center for Defense Studies, ITUV-SAM (1993 – 1998 and 2000–2002) and with University of Massachusetts, Lowell (UML) MA/USA as a full-time faculty (2012 – 2013), DOGUS University (2001-2014), Istanbul OKAN (2014 - 2021), and ATLAS (2022-2024) Universities.

He served four years (2020-2023) as an IEEE AP-S Distinguished Lecturer. Since Jan 2024 he has been the chair of the IEEE AP-S DL Committee. He served one-term in the IEEE AP-S AdCom (2013-2015) and one-term and as a member of IEEE AP-S Field Award Committee (2018-2019). He had been the writer/editor of the "Testing ourselves" Column in the IEEE AP Magazine (2007-2021), a member of the IEEE AP-S Education Committee (2006-2021), He also served in several editorial boards (EB) of other prestigious journals / magazines, such as the IEEE AP Magazine (2007-2021), Wiley's International Journal of RFMiCAE (2002-2018), and the IEEE Access (2017-2019 and 2020 - 2022). He is the founding chair of the EMC TURKIYE International Conferences (www.emcturkiye.org).

He has been involved with complex electromagnetic problems for nearly four decades. His research study has focused on electromagnetic radiation, propagation, scattering and diffraction; RCS prediction and reduction; EMC/EMI modelling, simulation, tests and measurements; multi-sensor integrated wide area surveillance systems; surface wave HF radars; analytical and numerical methods in electromagnetics; FDTD, TLM, FEM, SSPE, and MoM techniques and their applications; bio-electromagnetics. He is also interested in novel approaches in engineering education, teaching electromagnetics via virtual tools. He also teaches popular science lectures such as Science, Technology and Society.

He has published many books / book chapters in English and Turkish, over 180 journal/magazine papers / tutorials and attended more than 100 international conferences / symposiums. His three books Complex Electromagnetic Problems and Numerical Simulation Approaches, Electromagnetic Modeling and Simulation and Radiowave Propagation and Parabolic Equation Modeling were published by the IEEE Press - WILEY in 2003, 2014, and 2017, respectively. His fourth and fifth books, A Practical Guide to EMC Engineering (Sep 2017) and Diffraction Modeling and Simulation with MATLAB (Feb 2021) were published by ARTECH HOUSE.

His h-index is 38, with a record of 5200+ citations (source: Google Scholar, Dec 2024).