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Friendship and Electromagnetics: In Memory of Professors Pedram Mousavi and Mojgan Daneshmand

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***Abstract*—This paper is dedicated to the memory of Professors Pedram Mousavi and Mojgan Daneshmand as well as their two daughters Darya and Dorina who tragically lost their lives on January 8, 2020 when Ukraine International Airlines Flight 752 was shot down shortly after takeoff near Tehran, Iran. Despite their young age, Professors Mousavi and Daneshmand were superbly accomplished scholars who had made important contributions to the fields of Electromagnetics, Microwaves, Sensors, and Antennas. More importantly, they have touched and changed the life of many students and scholars by their teaching and research programs. They were beautiful soles who had an even brighter future ahead of them and were on the path of offering far more to the scientific and academic communities. Their tragic death is a significant loss for our community as well as their friends and family. This paper reviews some of their scientific contributions and provides a brief commentary on the cherished friendship of the authors with them.**

Keywords—Pedram Mousavi; Mojgan Daneshmand

I. Introduction

In the early morning hours of Wednesday, January 8th 2020, Ukraine International Airline Flight 752 was shot down shortly after takeoff from Tehran International Airport. Onboard the flight were 176 passengers and the crew who all perished. Among the passengers were two of our colleagues and friends, Professors Mojgan Daneshmand and Pedram Mousavi, together with their young daughters Darya and Dorina (Fig. 1). They were returning back home to Canada after having visited their family and friends in Iran during the winter break. Hearing the news of this senseless tragedy was a great shock to all who knew them. We are all saddened beyond description by this tragedy and mourning the loss of this beautiful family.

Mojgan and Pedram were both faculty members at the University of Alberta in Edmonton and both were active members of the IEEE Antennas and Propagation and the Microwave Theory and Techniques societies. Despite their young age, both were superbly accomplished scholars who had made significant contributions to the scientific community and had trained numerous undergraduate and graduate students as well as post-doctoral research fellows and visiting scientists. They both had much more to contribute to the world. In this paper, we will provide a brief and non-exhaustive review of their educational and research backgrounds and review some of their scientific contributions. We will also provide a brief note on our cherished friendship with Mojgan and Pedram.

Fig. 1. Professors Mojgan Daneshmand, Pedram Mousavi and their two daughters Darya and Dorina (March 19, 2019).

II. Professor Pedram Mousavi

Professor Pedram Mousavi received his B.S. degree from Iran University of Science and Technology in 1995 and the M.S. and Ph.D. degrees from the University of Manitoba in 1997 and 2001 respectively, all in Electrical Engineering. He was a professor with Department of Mechanical Engineering and an NSERC-AI Industrial Research Chair in Intelligent Integrated Sensors and Antennas at the University of Alberta. He was an associate editor of the IEEE AWPL. Pedram had over 15 years of entrepreneurial experience with start-up companies at University of Waterloo and the University of Alberta. He founded Intelwaves Technologies as a spin-off from the University of Waterloo. He was also a co-founder of WiDyne Technologies and SenZioT Technologies from the University of Alberta.

Pedram had a very active research and graduate training program at the University of Alberta. As a teacher, he taught courses covering the topics of modern antenna manufacturing, quality control, and applications; intellectual property and new technology commercialization; engineering management; and computer programming for engineers. Throughout his

productive career, he trained or was actively advising more than 30 post-doctoral, doctoral, and master's students. The focus of his research was applied electromagnetics with emphasis on intelligent integrated multifunctional sensors and antennas. One of his missions was to foster a strong collaboration between industry and academia and stimulate industry-relevant research in wireless technologies at the University of Alberta. Towards this goal, he applied his expertise to a diverse set of interesting problems with real-world applications. A few examples of his work include the development of low-cost phased-arrays [1], integration of polarization selective surfaces and antennas for multipath interference mitigation [2], development of wireless sensor networks for oil rigs [3], wireless and single-conductor wired power transmission techniques [4], novel manufacturing techniques for RF/microwave circuits [5], and wide range innovative wireless sensors and sensing design techniques [6]. Next, we briefly discuss one of his innovative contributions.

In [6], Prof. Mousavi and a teammate present sensors that requires no power to perform sensing or data transmission. They proposed a novel microwave sensor architecture based on the direct-conversion principle. In this technique, a base station transmits a continuous-wave signal with a frequency of $f_0/2$ towards the sensor. Using a combination of a passive frequency doubler and a multi-port network, the sensor modulates the data and transmits it back at f_0. The team implemented their sensor using a six-port modulator and four similar sensitive capacitive resonators. In this implementation, a pair of resonators senses the variation of a sample under test while the other pair is covered by a reference or known material. At the base station, any quadrature receiver can be used to demodulate the sensing data. With the ever-increasing use of sensors and the emergence of sensor networks in our everyday lives, the task of powering up the sensors becomes a major challenge. In this work, Prof. Mousavi's group provided a clever, simple, and low-cost technique to address this challenge.

III. Professor Mojgan Daneshmand

Professor Mojgan Daneshmand received her B.S. degree from Iran University of Science and Technology in 1999, the M.Sc degree from the University of Manitoba in 2001 and the Ph.D. degree from the University of Waterloo in 2006 all in Electrical Engineering. She was a professor at the Department of Electrical and Computer Engineering of University of Alberta. From 2008-2019 she held the Canada Research Chair Tier II on RF sensing and communication for applications in energy systems, wireless and satellite payloads, and biomedical devices. She was a recipient of the 2016 IEEE AP-S Lot Shafai Mid-Career Distinguished Achievement Award. Among many professional contributions, she served as an associate editor of IEEE TAP and J-ERM. As a teacher, Mojgan taught interdisciplinary group of courses covering wide range of topics including circuits, microwave engineering, and nanofabrication. Throughout her productive career, she trained or was actively advising more than 20 doctoral and master's students. Her research group has pioneered works on non-contact microwave sensing [7-9] and advanced satellite and wireless RF front end systems [10].

In [8], Prof. Daneshmand's group reported a new distant microwave sensing platform for monitoring the concentration of glycerol in a water and serum solution inside a microfluidic channel. Measuring glycerol concentration is important since it acts as a biomarker in many diagnostic applications, such as hyperglyceridaemia and coronary heart disease. The group developed a sensor that uses a microstrip line reader with a defected ground plane coupled to a chipless microwave resonator tag. The sensor was demonstrated to be capable of performing nanoliter-scale chemical sensing inside the microfluidic channel. The proposed solution provides opportunity of integrating the chipless passive tag with the microfluidic channel while the reader is distant from the microfluidic system.

IV. Friendship and Electromagnetics

We had the privilege of being friends with Pedram and Mojgan. Living in different countries and states, the annual IEEE AP-S and EuCAP symposia were the primary venues for us to see each other. On the sidelines of these conferences, we would gather to talk about our lives and families, do sightseeing, enjoy each other's company, and sometimes talk about research too. Electromagnetics was the force that brought us together but friendship and camaraderie kept us together. Pedram, Mojgan, and their two daughters were beautiful soles. We will always remember their smiley faces and miss them dearly.

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