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TABLE OF CONTENTS

In Memory of Gerald “Jerry” Burke
Edmond K. Miller, Andrew J. Poggio, and Jim Breakall..... Intro

Non-uniform Feeding Network for a Dual Circularly Polarized 16×16 Ku-Band Antenna Array
for On-Move Satellite Communication
Walaa M. Hassan, Khalid M. Ibrahim, Esmat A. Abdallah, and Ahmed M. Attiya..... 115

Compact 5G Hairpin Bandpass Filter Using Non-Uniform Transmission Lines Theory
Sahar Saleh, Widad Ismail, Intan S. Zainal Abidin, and Moh’d H. Jamaluddin..... 126

Gain Enhancement of a Traditional Horn Antenna using 3D Printed Square-Shaped Multi-layer
Dielectric Lens for X-band Applications
Aysu Belen, Peyman Mahouti, Filiz Güneş, and Özlem Tari 132

A New Metasurface Structure for Bandwidth Improvement of Antenna Array
Lan Ngoc Nguyen 139

A Compact CPW-Fed UWB Antenna with Dual-Band Notched Characteristics for
WiMAX/WLAN Applications
Rabah W. Aldhaheri, Ibrahim S. Alruhaili, Kamili J. Babu, and Muntasir M. Sheikh..... 145

A Frequency and Polarization Reconfigurable Dual-Patch Microstrip Antenna for Wireless
ISM Band
Cong Danh Bui, Thanh Cuong Dang, Minh Thuan Doan, and Truong Khang Nguyen..... 152

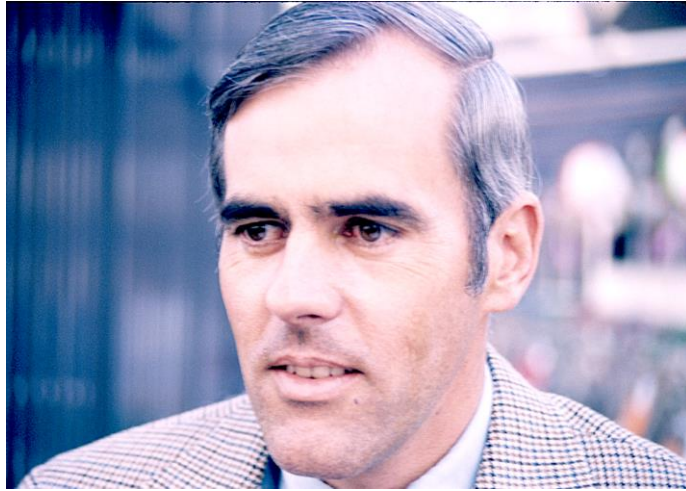
Efficient Electromagnetic Analysis of a Dispersive Head Model Due to Smart Glasses Embedded
Antennas at Wi-Fi and 5G Frequencies
Fatih Kaburcuk and Atef Z. Elsherbeni..... 159

Frequency Band Rejection Technique Based on the Operating Modes for a Wideband
H-Shaped DRA
Feras Z. Abushakra and Nathan Jeong 168

Uncertainty Quantification of the Crosstalk in Multiconductor Transmission Lines via Degree
Adaptive Stochastic Response Surface Method
Quanyi Yu, Wei Liu, Kaiyu Yang, Xilai Ma, and Tianhao Wang 174

Evaluation of Power Receiving Signal of 5G Small Cells for Outdoor/Indoor Environment at Millimeterwave Bands Naghham Hamid.....	184
Spread Spectrum Time Domain Reflectometry and Steepest Descent Inversion to Measure Complex Impedance Samuel R. Kingston, Hunter Ellis, Mashad U. Saleh, Evan J. Benoit, Ayobami Edun, Cynthia M. Furse, Michael A. Scarpulla, and Joel B. Harley	190
Dual-Mode Filter with High Design Flexibility Using Short-Loaded Resonator Zhaojun Zhu, Ke Yang, Xiufeng Ren, and Lu Cao.....	199
Analysis of EMI from Pantograph-catenary Arc on Speed Sensor Based on the High-speed Train Model Yutao Tang, Feng Zhu, and Yingying Chen	205
Studying and Analysis of a Novel RK-Sinc Scheme Min Zhu.....	213
Design and Analysis of a Novel Hybrid Excitation Flux Reversal Machine Xianming Deng, Zhen Jia, and Xiaohan Zhao	218

In Memory of Gerald “Jerry” Burke



By: Edmund K. Miller and Andrew J. Poggio

Jerry Burke died on February 14, 2021 from esophageal cancer. He had earned a B.S. and M.S. in Electrical Engineering from the University of California, Berkeley in 1965 and 1968 respectively. Ed Miller first met Jerry in 1968 at MBAssociates in San Ramon, CA, where he had worked since 1966. Andy Poggio joined our group at MBA in 1969. We, and with others at MBA at the time, continued development of one of the first general-purpose computer codes for modeling wires. This code, originally called BRACT (don't ask) transitioned to ANTBRACT, AMP (Antenna Modeling Program) and NEC (Numerical Electromagnetics Code, the latter a name suggested by Carl Baum).

Jerry had become a mainstay in the MBA/LLNL EM modeling activities. During his years at MBA he was instrumental in transforming BRACT into an effective tool for modeling antennas near an interface. After hearing for the first time about time-domain, integral-equation modeling at a 1968 APS meeting in Boston, from Edward Sayre and C. L. Bennett, Ed returned to MBA and suggested that this technology be pursued. Jerry was given some time to explore this possibility and in about 2 weeks had written the first version of what eventually came to be called TWTD (Thin-Wire Time-Domain). This code later became instrumental in designing an RFID tag for cattle after modification by Jeremy Landt, initially at LLNL and further at Los Alamos National Laboratory. Jerry also developed a technique for interpolating frequency-domain antenna and RCS data with something he termed FDI (Frequency-Derivative Interpolation). This was the forerunner of what eventually became MBPE (Model-Based Parameter Estimation).

Andy and Jerry later joined Ed in the Wave Theory and Applications Group at Lawrence Livermore National Laboratory in 1973 and 1975 respectively. Subsequently, with support from Army, Navy, and Air Force sources including Naval Ocean Systems Center in San Diego, they produced a popular 3-volume document for NEC [G. J. Burke and A. J. Poggio, “Numerical electromagnetics code (NEC)-method of moments, Part I: Theory, Part II: Code, Part III: User’s manual,” NOSC TD-116, Naval Ocean Syst. Center, San Diego, CA, July 18, 1977 (NEC-1). revised Jan. 2, 1980 (NEC-2)]. Versions NEC-3 and NEC-4 followed over the next 15 or so years [G. J. Burke, E. K. Miller, and A. J. Poggio (2004) “The numerical electromagnetics code (NEC)—A brief history,” *2004 IEEE Int. Antennas Propagat. Symposium Digest*, vol. 42, pp. 2871-2874, June]. Just before he died, Jerry had completed rewriting the basis of NEC-4, renamed the modified code, NEC-5, and had begun to distribute it through LLNL. Over the years after he left LLNL in 1985 and until just the past year, Ed felt fortunate to be able to maintain a continuing collaborative working relationship with Jerry. This mostly involved Jerry’s responding the Ed’s request for changes or additions to be made to NEC and TWTD in order to explore various topics of special interest for which he is very grateful. Jerry’s accommodation of these requests led to several joint publications in model-based parameter estimation, electromagnetic radiation physics, and chiral media.

Although a quiet and unassuming person, Jerry was gifted analytically, an outstanding programmer and talented numerical analyst. He was a valued colleague and friend that we were privileged to know and work with for over 50 years. Our records show that one or both of us (and others at times) were coauthors of more than 80 journal articles and conference presentations. Jerry also lectured at short courses and workshops in a variety of locales in the US and South Africa, Italy, Japan, Australia and Sweden. The EM modeling community will miss him.

By: Jim Breakall

It is with great sadness that I inform the ACES community and others of the passing of Jerry Burke on February 14th, 2021. Jerry received his B.S. and M.S. degrees in Electrical Engineering from the University of California – Berkeley, Berkeley, CA, in 1965 and 1968, respectively. In the mid-60s after graduation he joined a small company, MBA Associates that was working on chaff for radar cross section (RCS) decoys. A method was needed to predict the RCS of the chaff, and Jerry and others developed the first version of an antenna modeling program called BRACKT in 1967. Jerry implemented the three-term basis function (constant – sine – cosine) from Prof. Ken Mei at Berkeley that became the main type of basis function for all future versions. This basis function was a huge improvement over pulse and triangle type functions used up to then resulting in very fast convergence of results, and therefore, a smaller number of segments needed. Jerry and others then added a voltage generator and reflection coefficient approximation ground to allow the code to model the transmitting situation over earth since it was only used for RCS up to that time. This version was called ANTBRACKT, and the year was 1968. MBA Associates was fortunate to win a large contract in 1971 from the government (Navy, Army, and Air Force) to extensively upgrade ANTBRACKT to a version named AMP (Antenna Modeling Program). Ed Miller, Andy Poggio, and Jerry then joined the Lawrence Livermore National Laboratory (LLNL), Livermore, CA in 1971, 1973, and 1975, respectively, and that was the start of what became the code most known today as the Numerical Electromagnetics Code (NEC). AMP incorporated the electric field integral equation (EFIE) for thin wires and the magnetic field integral equation (MFIE) for voluminous surfaces that was added later becoming AMP2 in 1975. The capability of AMP2 was demonstrated by the accurate modeling of a Navy frigate in 1975. Throughout this early development, it was mainly Jerry Burke who was the master of Fortran programming and algorithmic implementation in all of these codes.

In 1977, the interest was on Electromagnetic Pulse (EMP) effects on aircraft from the Air Force Weapons Lab (Carl Baum) and shipboard communications from the Naval Ocean Systems Center (Jay Rockway). They both suggested that AMP should be improved, and Carl Baum came up with the name of the Numerical Electromagnetics Code (NEC). They actually wanted a suite of NEC family codes and also funded the development of the NEC Basic Scattering Code (NEC-BSC) at Ohio State (Ron Marhefka). The hybridization of both NEC and NEC-BSC allowed the method of moments (MoM) analysis and the uniform (geometric) theory of diffraction (UTD-GTD) to be used to solve problems over a very wide frequency range. Again, Jerry Burke was instrumental in making all of this happen.

Continual improvements were being incorporated into now NEC at LLNL and the need for accurate modeling near the earth was needed. Jerry and others came up with a very clever interpolation scheme named Model-Based Parameter Estimation (MBPE) for the complex Sommerfeld integrals needed. This became NEC2 in 1980 and is now released in the public domain. Jerry again was the person who made this happen with his extensive analytical skills in the complex plane of Sommerfeld integrals and his ability to produce very efficient and fast Fortran code. I remember contacting Jerry around this time as a graduate student at Case Western Reserve University, and that was our first time to meet on the phone. Jerry was very excited to hear a student was so interested in antenna modeling, and he sent me all the huge manuals and a computer tape with the code on it. I never paid a cent and was so grateful. I had used AMP back at Penn State in the late 1970s for modeling a large HF heating array at Arecibo Observatory that consisted of many log periodic antennas. NEC was even more advanced, and it could do so much I thought as a young Ph.D. student at the time. Jerry said to call him if I ever had any questions, and I must admit that I kept his phone busy. Bob Collin, Professor at Case and fellow Ph.D. student, Georg Karawas, and I at that time used to have many conversations about NEC, MoM, Jerry Burke, Ed Miller, and LLNL. Bob was writing another book at the time *Antennas and Radiowave Propagation* that discussed MoM. I remember those conversations fondly with Jerry, Bob, and Georg.

Fortune would have it that my dream came true to get an offer from LLNL in 1983 to work with Jerry and Ed and others there on NEC and other projects. I remember that my hotel reservations got messed up when I got there, and there was no room available with some big conference at LLNL. I called Ed, and he said come over to his house and stay. I will never forget that night with Ed and I staying up to the wee hours of the night talking about antennas and Jerry and my conversations with him while a graduate student. What a thrill it was I remember for the first time to meet Jerry in person on that interview and hear all the things he was doing to NEC at the time.

During 1983, we released NEC3, and I was involved in the releases for the DEC VAX and similar computers. NEC3 could model wires buried in the ground and had many other improvements mainly put in by Jerry. I remember many times I would try things with NEC and other methods and tell Jerry that something was not quite correct, for example it would give errors when trying to model stepped-diameter wires. Jerry would come back some days, or weeks later at the most, and say he put in some mini-FDTD method for the step in the diameter, and it was fixed. It seemed Jerry knew the inside of that code so well, that he could fix anything we would tell him. All of these things eventually created the final version that was funded by the Army and Navy, NEC4. I remember once that some of us were working on monopole ground systems with maybe some 120 radial wires. Jerry put together a highly efficient version of NEC3 called NEC Ground Screen (NECGS) that was extremely fast for this specialized problem. I also was involved with making helicopter measurements of HF antennas in irregular terrain and using NEC-BSC type of methods to model this scenario. The results were very close, and I remember Jerry writing some custom code to do the same thing with high accuracy and efficiency and reporting on that in a LLNL technical document. LLNL still has the licensing of NEC4, and fortunately, NEC2 is now in the public domain, and there are many versions of it available for free online (4NEC2, CocoaNEC, etc.) or commercially (EZNEC, NEC-WIN), etc.). Before Jerry's death, on his own time, he wrote a new version, NEC5, that can model wires and surfaces. I have not tried it yet myself as of this writing, but plan to get a copy and do so. I am sure it will be right up there with anything that Jerry has ever created.

Jerry was a very humble person and was not outwardly social. Jerry was the person who was quiet in a crowd and would never be forward or take credit for things. He would go on weekends from Livermore to San Mateo where he grew up and take care of his mother there. When she died and he retired from Livermore, he moved into the house he grew up in. Jerry was a confirmed bachelor for most of his life but finally found the love of his life and got married several years ago. I know he was really happy and did a lot of traveling. He still was active in antenna modeling and still would go into LLNL monthly on his own time I heard. I know that Jerry liked to ski and would go with other workers at LLNL on ski trips to the Sierras. I always enjoyed being with Jerry on trips to sponsors or to conferences. We would hang out together, and Jerry liked good restaurants and food.

It is hard to believe he is not with us anymore. I had just found some new results about that same stepped-diameter wire problem, that I discussed before, and was going to send my results for his comments. That will not happen now, but I will never forget all of the great times and just what a pleasure and honor it was to know Jerry. His legacy with NEC will live on for sure. I would like to speak for all of his friends at LLNL and the antenna community to pass on our sincere condolences to Jerry's wife and family. We all will really miss him so much. Rest in peace Jerry.