

MFI 2015 TUTORIAL PROPOSAL

TITLE: Advances in Statistical Multisource-Multitarget Information Fusion

PRESENTER: Ronald Mahler

DESCRIPTION: Finite-set statistics (a.k.a. random set information fusion) was first systematically described in the 2007 book, *Statistical Multisource-Multitarget Information Fusion* (an authorized Chinese-language edition appeared in 2014). Since then it has attracted considerable international interest, pursued by many dozens of research groups in at least 18 nations, resulting in over a thousand publications. As a consequence, since 2007 progress in the field has been unexpectedly rapid and has proceeded in diverse and sometimes unexpected directions, propelled by many clever new ideas. The 2014 sequel, *Advances in Statistical Multisource-Multitarget Information Fusion*, systematically described the most intriguing aspects of this new research and integrated them into a single coherent picture. This three-hour tutorial is an overview of the current state-of-the-art, as reported in that book and elsewhere. While an introduction to the elements of finite-set statistics will be included, some familiarity with topics such as PHD and CPHD filters will be helpful.

Topics: (1) Introduction (the philosophy of, and misconceptions about, finite-set statistics). (2) Elements of finite-set statistics (RFS's; and multitarget calculus, statistics, modeling and filtering, and metrology). (3) RFS filters for the standard measurement model (PHD/CPHD filters, multisensor PHD/CPHD filters, jump-Markov PHD/CPHD filters, Bernoulli and multi-Bernoulli filters, multitarget smoothers, exact-closed-form multitarget filter, unified simultaneous localization and mapping, unified track-to-track fusion, and unified multitarget tracking and sensor-bias estimation). (4) RFS filters for unknown, dynamic clutter and detection backgrounds. (5) RFS filters for nonstandard measurements (imaging, superpositional, extended-target, cluster-target, group-target, and human-mediated). (6) Introduction to RFS sensor management.

BIOGRAPHY: Ronald Mahler has a Ph.D. in mathematics and a B.E.E. in Electrical Engineering and, from 1974-1979, was a mathematics professor at the University of Minnesota. Until his recent retirement he was a Senior Staff Research Scientist at Lockheed Martin Corp., responsible for numerous R&D projects. Currently he is a private consultant. Dr. Mahler is the founder of, and a leading researcher in, the random finite set (RFS, a.k.a. "finite point process") approach to information fusion. He is author or coauthor of over a hundred publications in the specialty, including nearly two dozen journal papers and three books: *Mathematics of Data Fusion* (1997), *Statistical Multisource-Multitarget Information Fusion* (2007) and *Advances in Statistical Multisource-Multitarget Information Fusion* (2014). Two of these are the most-cited and fourth-most-cited papers published in *IEEE Trans. Aerospace & Electronic Sys.* over the last decade. He has been invited to speak at numerous universities, U.S. Department of Defense Laboratories, and conferences, including a keynote address at FUSION2004. He is recipient of the 2007 Mignogna Data Fusion Award, the 2005 IEEE AESS Mimno Award, and the 2007 IEEE AESS Carlton Award. He has been listed since 2010 in *Who's Who in America* and *Who's Who in the World*.