UNIVERSITÀ DI PISA

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

Dottorato di Ricerca in Ingegneria dell'Informazione

Doctoral Course

Signal Processing for Joint Radar Communications

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Short Abstract: The course builds on the contents of the edited book of the same name published by Wiley Press. The course aims to shed light on various signal processing theory and methods for design, operation and optimization of joint radar and communications. It is divided into four major topics staring from the Fundamentals, Physical layer Signal Processing, Higher layer aspects, and Applications and Hardware implementations.

Course Contents in brief:

1. **Fundamental Limits and Background**: The course begins with a historical context, nomenclature, classification, and the principles of Joint Radar Communication (JRC) systems. Interference, Clutter Mitigation and Information theoretic aspects will be covered
2. **Physical Layer Signal Processing**: This topic deals with the various types of physical layer signal processing for JRC, largely focusing on enabling spectrum sharing in coexistence and co-design scenarios
3. **Higher Layer aspects**: This topic will build on the physical layer content delivered earlier and includes classical resource allocation in the new paradigm as well as the emerging topics of secrecy and privacy.
4. **Applications and Hardware implementations**: Several applications of JRC are presented including the system model, design objectives and constraints and performance of JRC systems. Hardware implementations enhancing the credibility will be shown

Total # of hours of lecture: 16 + 4 hrs of exam

References:

1. **Signal Processing for Joint Radar Communications** Editor(s): Kumar Vijay Mishra, M. R. Bhavani Shankar, Björn Ottersten, A. Lee Swindlehurst, First published:6 March 2024, Print ISBN:9781119795537 |Online ISBN:9781119795568 |DOI:10.1002/9781119795568

CV of the Teacher

M. R. Bhavani Shankar received Masters and Ph. D in Electrical Communication Engineering from Indian Institute of Science, Bangalore in 2000 and 2007 respectively. He was a Post Doc at the ACCESS Linnaeus Centre, Signal Processing Lab, Royal Institute of Technology (KTH), Sweden from 2007 to September 2009. He joined SnT in October 2009 as a Research Associate and is currently a Senior Research Scientist/ Assistant Professor at SnT leading the Radar Signal Processing activities. He was with Beceem Communications, Bangalore from 2006 to 2007 as a Staff Design Engineer working on Physical Layer algorithms for WiMAX compliant chipsets. He was a visiting student at the Communication Theory Group, ETH Zurich, headed by Prof. Helmut Bölcskei during 2004. Prior to joining Ph. D, he worked on Audio Coding algorithms in Sasken Communications, Bangalore as a Design Engineer from 2000 to 2001. He is currently the Chair of the IEEE Benelux joint chapter on communications and vehicular technology, serves as associate editor for IEEE TAES and is a member of the IEEE SPS SAM Technical Committee. He was a co-recipient of the 2014 Distinguished Contributions to Satellite Communications Award, from the Satellite and Space Communications Technical Committee of the IEEE Communications Society and co-author of the paper that received Special Mention for the Barry Carlton best paper award by IEEE TAES in 2023.

Final Exam: The fifth day will involve presentations of papers chosen by a group of participants from a topical list. Depending on the number of students, the groups and the presentation duration will be adjusted. The students can also present any work of their choice (except their own publication).

Room and Schedule

Room: *Aula Riunioni del Dipartimento di Ingegneria dell'Informazione, Via G. Caruso 16, Pisa – Ground Floor* e *Aula Riunioni del Piano 6 del Dipartimento di Ingegneria dell'Informazione, Largo Lucio Lazzarino 2, Pisa*

Schedule:

Day 13/07/2026 09:30- 12:30 – Via Caruso

Day 14/07/2026 14:30-18:30 – Via Caruso

Day 15/07/2026 09:30-12:30 – Via Caruso

Day 16/07/2026 14:30-18:30 – Largo Lucio Lazzarino