Noise Based Transmitted Reference Modulation for Wireless Sensor Networks

Mahdin Mahboob\textsuperscript{1}, Arjan Meijerink\textsuperscript{1}, Sarwar Morshed\textsuperscript{2}, Geert Heijenk\textsuperscript{2}, Mark Bentum\textsuperscript{1}

University of Twente
\textsuperscript{1}Telecommunication Engineering Group, 
\textsuperscript{2}Design and Analysis of Communication Systems Group, 
P.O. Box 217, 7500 AE, Enschede, The Netherlands
Email: m.mahboob@utwente.nl

1) Wireless Sensor Networks
- Battlefield
- Temperature control
- Agriculture
- Healthcare
  → Low power consumption
  → Harsh EM environments (with multipath fading and interference)

2) Spreading Techniques
- Immunity to interference
- Robustness to multipath fading
- Coexistence with other devices in the same spectrum space
- Example: ultra-wideband (UWB)

3) Transmitted Reference Modulation
- Both modulated and unmodulated signals sent
- Distinguished at the receiver by time offset
- Demodulation by means of self-correlation
- Multiple access by using different offsets
- Instead of time offset, frequency offset may be used (easier implementation at chip level)
  - No Channel state information required
  - Faster signal acquisition
  - No stable oscillators required → low complexity
  - Inherent multiple access capability
  - Power penalty at bit level

  → Short-range, low-duty cycle applications → WSNs

4) WALNUT project

Wireless Ad-hoc Links using robust Noise-based Ultra-wideband Transmission

Cross-Disciplinary work in three fields:
- Physical Layer
  - Suitable noise-like carriers
  - Suitable modulation techniques and channel codes
  - Receiver structure design
- Integrated Circuit Design
  - Sensitive low-power receiver design
  - High efficiency power transmitters
- Communication Protocols
  - Medium access control
  - Power control
  - Packet scheduling

Ultimate aim: realize a robust noise-based radio link using low-power ICs combined with relevant MAC protocol

http://www.utwente.nl/ewi/te/projects/SRR/walnut

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