1. ECE 510 (ECE 581A7): Wide-Area Monitoring for Power Systems

2. 3 credits: 2-75 minute lecture sessions/week

3. Liuqing Yang

4. None
    a. Synchronized Phasor Measurements and Their Applications. Phadke, A. G. & Thorp, J. S. 2008.
    b. Application of Time-Synchronized Measurements in Power System Transmission Networks. Kezunovic, m., Meliopoulos, S., Venkatasubramanian, V. & Vittal, V. 2014.
    c. IEEE Standard for Synchrophasor Measurements for Power Systems. IEEE. 2011.
    d. IEEE Standard for Synchrophasor Measurements for Power Systems Amendment 1: Modification of Selected Performance Requirements. IEEE. 2014.

5. Course Information
    a. WAMS for modern power grid including signal processing, communications and networking techniques in WAMS/WAMS applications
    b. Prerequisites: ECE 312 with a C or higher; ECE461 with a C or higher
    c. Selected Elective: Electrical Engineering; Computer Engineering

6. Goals for the Course
    a. Course Learning Outcomes
        i. Identify core components of a wide-area monitoring systems WAMS) for power systems
        ii. Describe signal processing techniques based on phasor measurement unit (PMU) devices
        iii. Describe the communication and networking structure of WAMS and the associated storage, processing, and security issues
        iv. Work on various applications of WAMS under both steady-state and dynamic operations of power systems
    b. Student Outcomes
        1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

7. Topics Covered
    Challenges of the modern power grid
    Traditional power system monitoring: SCADA
    WAMS basics
    Phasor Measurement Unit (PMU)
        History and evolution
        Phase frequency estimation
        PMU transient response
        Industrial synchrophasor standards

Communication and networking for WAMS
- Phasor data concentrator
- Coding and communications
- Networking and communication security

WAMS applications
- Power system steady-state operation: state estimation and power flow analysis
- Power system dynamic operations: small signal analysis and transient stability
- WAMS for integration of renewable resources and energy storage