TIC-188 Signal Processing in Telecommunication Systems

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The “Signal Processing in Telecommunication Systems” research group works mainly on applications for signal processing and artificial intelligence, acoustic intelligence, music technologies and characterization and inspection of materials by means of non-destructive trials with ultrasound.

In carrying out its work, the group has the following specialized equipment in place:

- **Signal conditioner Model: PCB 482A18.** 8-channel signal conditioner, programmable gain (x1, x10 and x100), with BNC-type inputs/outputs, PC-configurable via Ethernet. Use: impact-echo signal conditioning.
- **Impact-echo sensors. Models: 8 PCB 535B17 sensors, 2 PCB 352A60 sensors.** High-frequency quartz sensors (1 to 10KHz) and ceramic sensors (5 to 60KHz). Use: impact-echo signal capture.
- **Impact hammers. Models: PCB 086D20, PCB 086E80.** Impact hammers in different sizes and covers of varying hardness equipped with sensor covering a range of frequencies up to 30 KHz. Use: impact for creating impact-echo signals.
- **Sound card. Model: Zoom F8.** 8 input channels (XLR/TRS), recording at 192 KHz, possibility of phantom power (24V and 48V), recording with SD, powered by AA batteries or AC adapter. Use: impact-echo signal recording.
- **Multichannel recording room.** 24 input channels, recording at 98 KHz, 8 arrays of 3 microphones each. Phase recording of all signals. Use: distant-microphone scene recording.
- **Oscilloscope. Model: Picoscope 6404D.** 4 channels, 500-MHz bandwidth, sampling of up to 5 GS/s, PC-configurable via USB. Use: ultrasonic signal recording.
- **Ultrasound pulser + Remote pulsers. Model: JSR DPR500, RP-L2 and RP-H4.** 2 500-MHz bandwidth channels, PC-configurable via serial port. Remote pulsers with different bandwidths (1-65 MHz and 40-165 MHz). Use: transmission/reception of ultrasonic pulses.
- **Ultrasonic transducers. Models: Olympus V317-SU-CF0.50IN-PTF, V320-SU-F3.00-IN-PTF, V212-BA-RM, V122-RM.** Immersion and contact transducers with 7.5- and 20-MHz frequencies. Use: transmission of ultrasonic waves.
- **High-performance computer nodes incorporating multiple calculation accelerators (with GPU-type architecture). Use for intensive calculation:**
  - DISCOSOUND server. 2 14-core Intel Xeon E5-2697V3 processors at 2.6GHz, 128 GB RAM, 1 NVIDIA TESLA K80 24GB and 24 TB GPU for HDD storage.
  - NDT server. 2 22-core Intel Xeon E5-2699V4 processors at 2.2GHz, 256 GB RAM, 1 NVIDIA TESLA P100 16GB and 480 TB GPU for SSD storage.
  - SSPRESSING server. 2 20-core Intel X400 Xeon SKL G6148 processors at 2.4GHz, 768 GB RAM, 3 NVIDIA TESLA V100 16GB and 480 GB GPU for SSD storage.
  - Mac Pro server. 1 8-core Intel Xeon E5 processor at 2.9GHz and 128GB RAM. Calculation server with one NVIDIA TITAN XP-PRO GPU, 64GB RAM and 4TB hard drive.

Research lines

- Processing of ultrasonic signals
- Audio restoration

- Music remastering (instrumental and vocal)
- Improving the quality and intelligibility of the human voice in noisy surroundings
- Videoconference applications
- Applications for processing ISAR images
- Detection of sound events
- Spatial localization of sound sources
- Analysis of biomedical signals
- Separation of sound sources
- Monitoring of scores
- Automatic accompaniment
- Metaheuristics applied to problems of distributed electric generation
- Image and video analysis
- Processing and analysis of three-dimensional point clouds

Related services and products

- System for the automatic classification of olives
- Automatic detectors and separators of anomalies in cardiopulmonary biomedical signals
- Software for improving interpretation of signals obtained by means of Ground Penetrating Radar (GPR)
- Restoration of old audio
- Music remastering (instrumental and vocal)
- Development of software in real time for the detection and localization of sound events
- Ultrasound-based quality control systems for industrial processes
- Drafting and leading projects and assignments in general: projects in telecommunication networks, ICT, acoustics, remote alarm, radio links, remote controls, etc.
- Expert reports, arbitrations, appraisals, inspections, etc.
- Measuring of radioelectric emissions
- Specialization courses in signal processing in communication systems

Spanish website: http://bit.ly/2SffKPN