Automotive Radar Stimulator Development

at the Institute of Microwave and Photonics Engineering

together with:

AVL

IRT
Why Automotive Radar Target Stimulation?

- Testing autonomous driving in real world is quite a challenge
- As much testing as possible by simulation and on a testbed:
  - Faster
  - Cheaper
  - Better repeatability
- On a testbed the sensors of the cars have to be stimulated
The Testbed

- Visualization System
- Sensor Interfaces
- Simulation Platform
- Wheel Dyno
- Steering Actuator
- Ultrasonic Stimulus
- Radar/Lidar/Camera sensors
- GPS stimulus
- Vehicle XCUs
- Vehicle Test Cell
- C2 X
- Vehicle Test Cell

Radar stimulus

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Helmut Schreiber
11.01.2018
Challenges for Target Stimulation

• Complicated real world scenarios:
  • Multiple targets
  • Multiple azimuth channels
  • Moving and stationary targets (clutter at the testbed)

• High processing bandwidth (up to 1 GHz and more)

• Large variation in distance (a few meters to hundreds of meters)
  • High dynamic range

• Fast response time (5 m correspond to 33 ns)
How to Stimulate a Radar Target

- The radar target stimulator has to create for each target
  - the correct distance by delaying the radar echo
  - the correct velocity by shifting the echo frequency
  - the correct target RCS by changing the signal amplitude
  - the correct angle
Structure of the Radar Target Stimulator - 1/2

- ABOUT 77 GHz, 1 GHz BW
- 1.5 - 2.5 GHz
- Radar Target Stimulator
- Digital & Analog Control Signals
- Control Unit

Simulation platform
• Highly scalable
  • in distance
  • in # of targets
• Switching without discontinuities in the signal‘s phase
• Flexible connection between delay module & target emulation module
• Does not depend on the radar‘s transmit signal form
Ongoing & future work

• Extending the stimulator to targets in multiple azimuth directions – allowing azimuthal movement
• Covering possible multipath propagation & possible interference by other radars
• Range extension by digital stimulation
  • Analog system with delay lines not feasible for longer ranges and many targets
• Integration in a test rig
• Simulation of clutter