School of Engineering

ISC Institute of Signal Processing and Wireless Communications

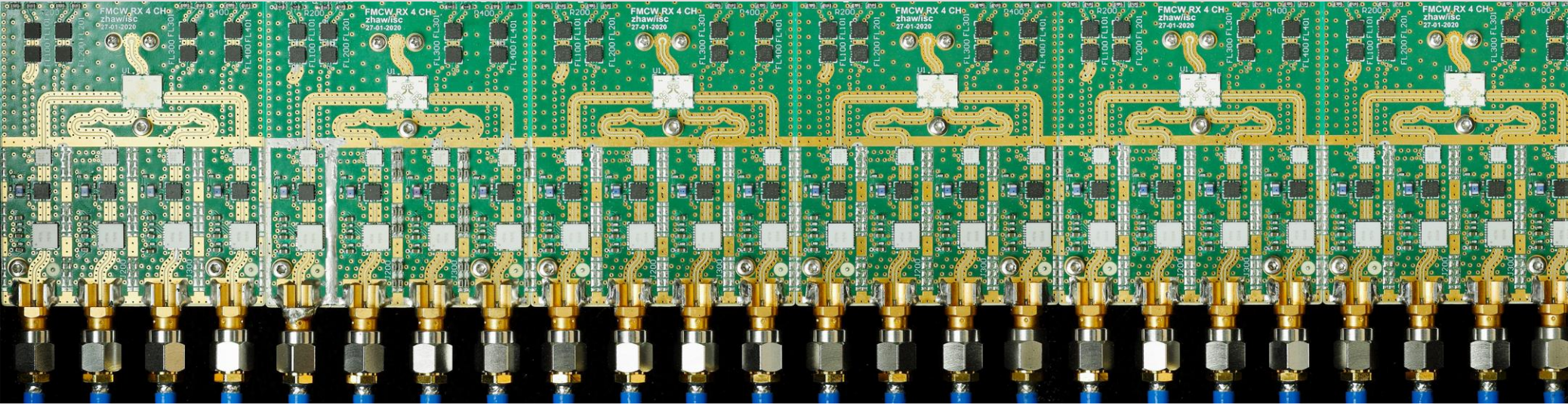
ISC-Presentation

24. Juni 2025

Contact
Prof. Dr . Marcel Rupf
Head of ISC, TNO4.24
Technikumstrasse 71
CH-8401 Winterthur
Tel: 058 934 71 29
marcel.rupf@zhaw.ch
www.zhaw.ch/isc
youtube

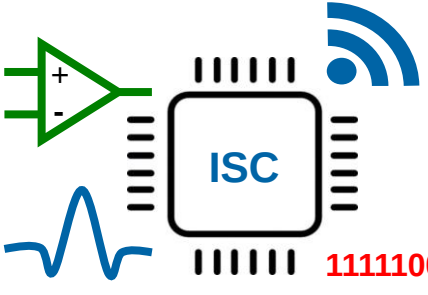
Gebäude TN, Technikumstrasse 71, Winterthur

ISC Institute of Signal Processing and Wireless Communications



Radar-Frontend 9-18 GHz, ISC, 2021.

Focus on the Signal Processing Chain from the Sensor / Antenna to Data Evaluation



A Motivated and Creative Team

Lecturers: **12**

Scientific Staff: **21**
(with Bachelor- or Master Degree in Electrical Engineering)

Office: **1**

Prof. Dr. Marcel Rupf
Head of Institute
and of Digital Signal
Processing Group

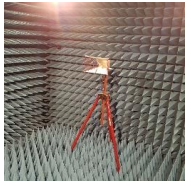
Dr. Marc Kuhn
Deputy Head of Institute

Patrick Rennhard
Head of Wireless
Sensor Systems Group

Prof. Dr. Luciano Sarperi
Head of Wireless
Communications Group

Prof. Dr. Teddy Loeliger
Head of Sensor
Electronics Group

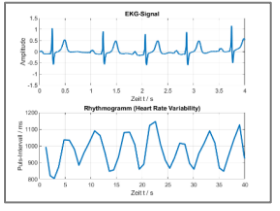
ISC-Focus on Research and Teaching

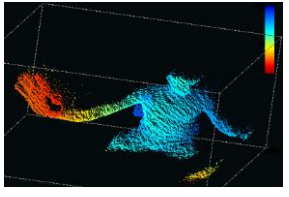


Design of low-noise and low-power electronics for analog frontends up to highest frequencies

Wireless communications with focus on PHY/MAC-layers and localisation

Processing of measurement-, sensor-, radio-, geo-, bio-, speech-, audio- and image-signals with efficient algorithms on multiple plattforms (CPU, GPU, MCU/DSP, FPGA, SoC)





Forms of Cooperation with Industry

R&D Direct Orders

- According to offer with scope of services, costs and deadlines

Funded Research Projects

- Innosuisse-Innoscheck (Testing the feasibility of a new idea)
- Innosuisse-Projekte (Development of prototypes for innovative products)

Student Projects in the Bachelor's or Master's Program

- For non-time-critical feasibility and technology studies

Workshops

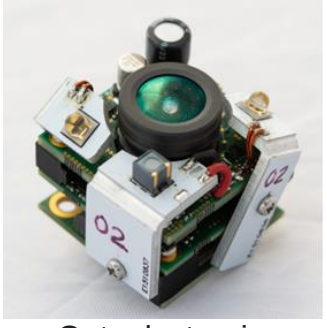
- For certain technologies or problems, also under NDA

Weiterbildungskurse (dt.)

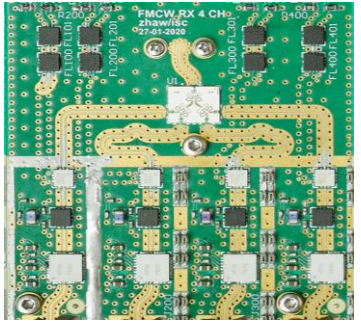
- WBK Hochfrequenztechnik, WBK Digitale Signalverarbeitung

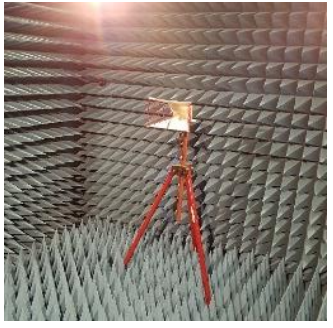
Sensor-Elektronics - RF-Technology

Design of low-noise and low-power electronics for analog frontends up to highest frequencies

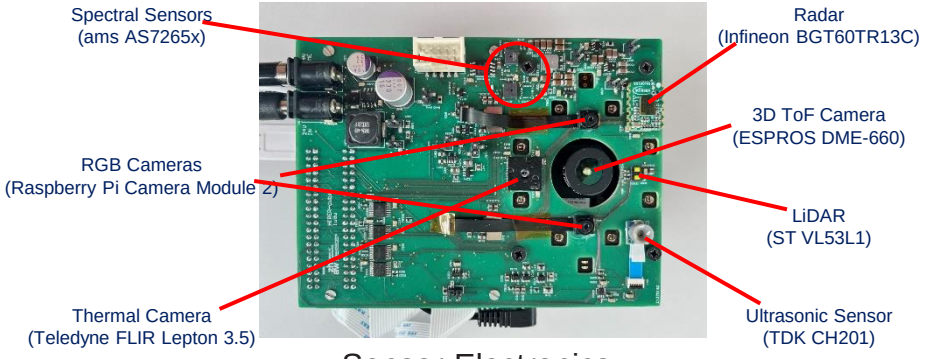


Optoelectronics
(small 3D-ToF-Module)

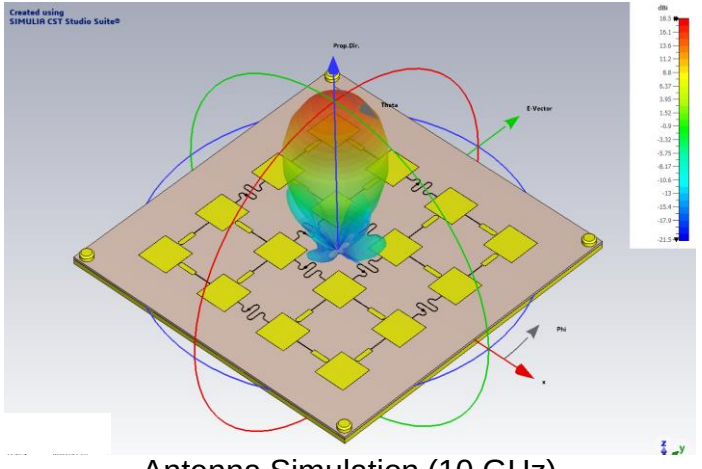




RF-Frontend and Antenna Measuring Chamber



Sensor-Electronics



Antenna Simulation (10 GHz)

Digital Signal - and Image Processing

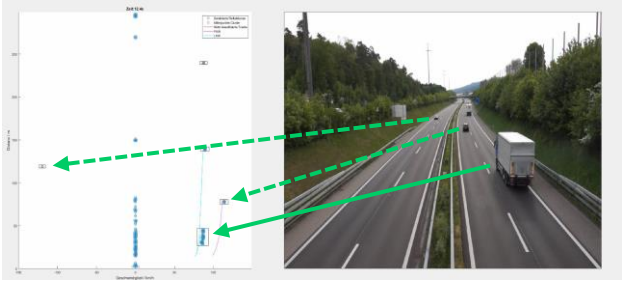
Processing of

- Measurement / Sensor Signals
- Radio Signals
- Geo / Bio Signals
- Speech / Audio Signals
- Images of multiple Cameras

with efficient algorithms on multiple plattforms

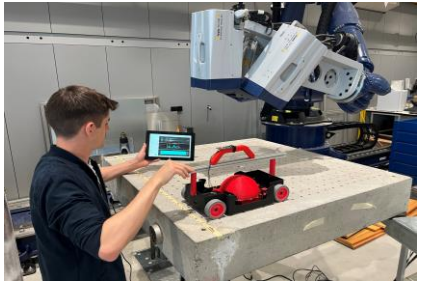
- MCU / DSP, FPGA, SoC
- GPU / CPU

IMU Signal Processing
(Data Fusion, Pose Tracking)

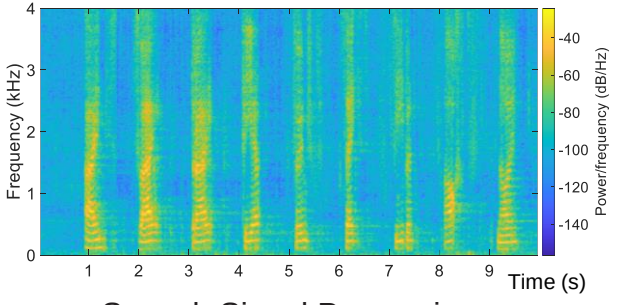


Radar Signal Processing
(Range-Doppler-Map, Kalman-Tracking)

Ultrasonic System
(Hauswasserzähler, GWF)

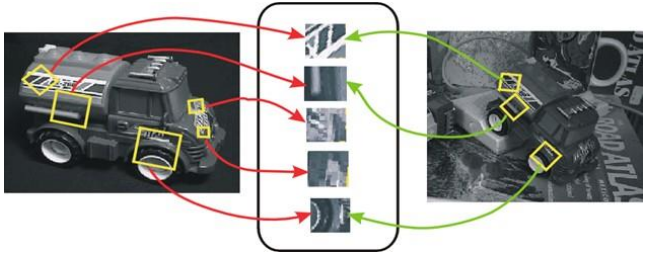


Non Destructive Testing
(acustic)



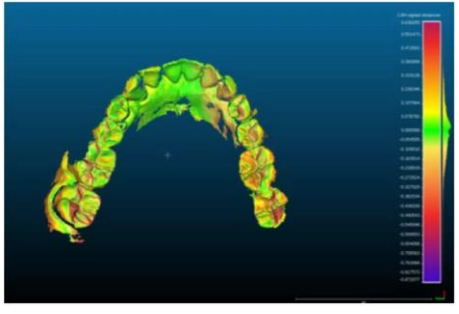
Speech Signal Processing
(Numbers 1-9, AI-based deverberation)

Digital Signal - and Image Processing



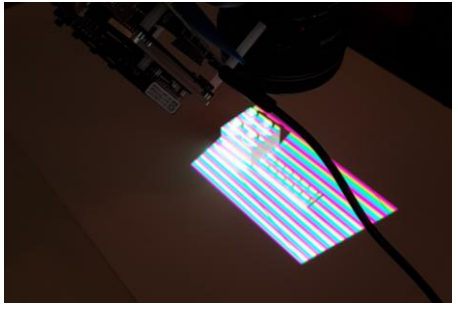
Scale-Invariant Feature Transform (SIFT)

Image Stitching



Depth Map
(of Intraoralscanner)

Video Processing
(Student project with TI-SoC)



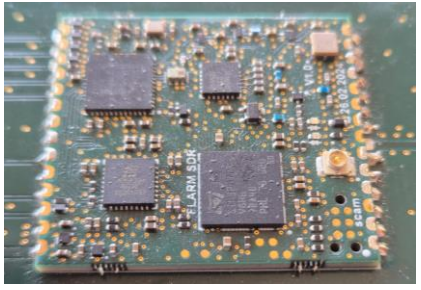
Color Fringe 3D Profilometry

Measurement Signal Processing
(Laserscanner, ELAG)

Wireless Communications

Wireless communications with focus on PHY/MAC-layers and Lokalisation

- RFID / NFC
- Bluetooth, WLAN / Wi-Fi
- LoRa (169/868 MHz / 2.4 GHz)
- UWB (Transmission, RTLS)
- Avionics (ADS-B, FLARM, ADS-B light)
- Mobile (4G/LTE Adv., NB-IoT, LTE-M, 5G)
- Radar (X-/K-band/mm-wave, FMCW, MIMO)
- GNSS (GPS/Galileo, RTK, GBAS)
- Software Defined Radio (SDR, GNU radio)
- Simulation of Radio Propagation

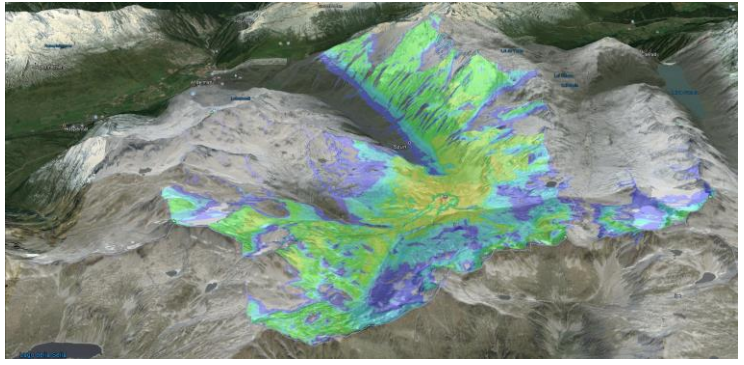


Avionics Receivers
(ADS-B 1090 MHz, FLARM 868 MHz)

Bluetooth
(one of the first "industrial" BLE applications in CH, CTI)

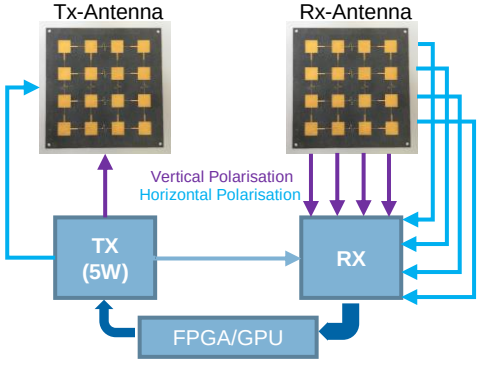
Wearable
(4G, GNSS, Bluetooth 5.0)

Wireless Communications

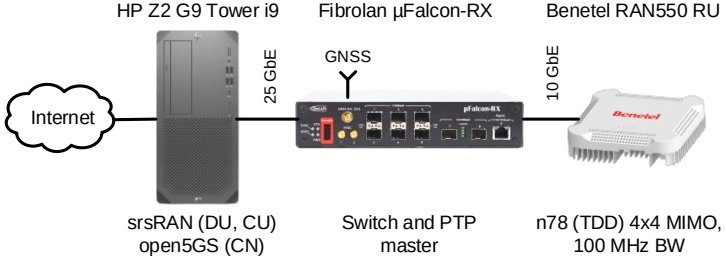


Simulation of LoRa coverage
(Radio Mobile, 868 MHz, LPWAN for livestock tracking)

Redundant Radio System
(sub 1-GHz, monitoring natural hazards)



X-Band FMCW Bird Radar
(block diagram)



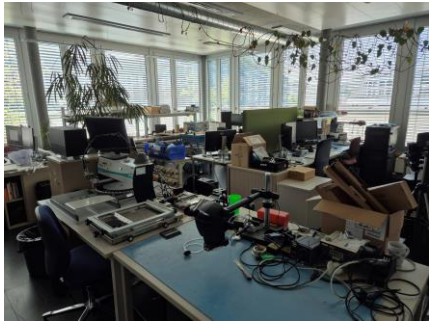
5G Campus Network

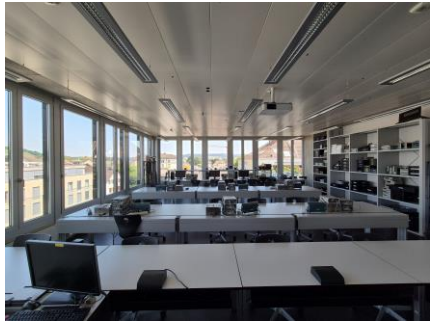
NB-IoT
(sensor and connectivity module)

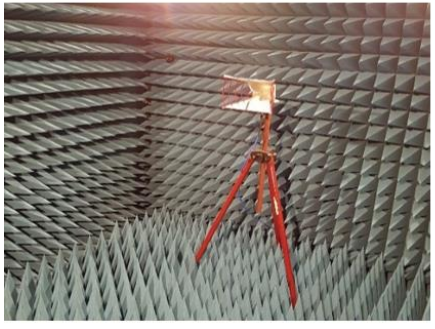
X-Band FMCW Bird Radar
(field test, Innosuisse-Project)

Laboratory Equipment

5 Teaching Labs and 3 R&D-Labs







Equipment

- Audiointerfaces and microfones
- RGB-, IR-, multispectral-, event-based-Cameras
- Digital oszilloscopes up to 40 GS/s
- Spectrum analyzer / RTSA up to 26 GHz (60-90 GHz)
- Vector network analyzers up to 20 GHz
- Field strength meter up to 3 GHz
- Signal generators / AWG up to 6 GHz
- SMD workplace with steam-phase soldering oven (VP 310 Asscon) and «Leichtmanipulator» Fritsch LM901
- GPS simulator / generator
- Rubidium time standards
- Climate control cabinet 37l, -40°C up to 180°C
- Antenna measuring chamber (LxBxH inside: 3.7 x 1.9 x 1.8 m, 500 MHz up to 110 GHz, 3D positioner DAMS 6000 with DFSM10-18)
- CST Studio, AWR Microwave Office, Altium, Matlab
- SoC / SoM boards, e.g. AMD RFSoC 4x2-Kit
- SDRs e.g. Ettus / NI
- small mechanical workshop and 3D printer