INFOTEHNOLOOGIA TEADUSKOND
RAADIO- JA SIDETEHNIKA INSTITUUT
TEADUS- JA ARENDUSTEGEVUSE AASTAARUANNE 2013

1. Struktuur

Raadio- ja sidetehnika instituut, Department of Radio and Communication Engineering
Instituudi direktor: dots. Toomas Ruuben

- Mikrolainetehnika õppetool, Chair of Microwave Engineering, õppetooli hoidja: dots. Toomas Ruuben
- Raadiotehnika õppetool, Chair of Radio Engineering, õppetooli hoidja: dots. Toomas Ruuben
- Signaalitöötluse õppetool, Chair of Signal Processing, õppetooli juhataja: prof. Tõnu Trump
- Telekommunikatsiooni õppetool, Chair of Telecommunications, õppetooli hoidja: dots. Eerik Lossmann

2. Teadus- ja arendustegevuse (edaspidi T&A) iseloomustus

2.1 Struktuuriüksusesse kuuluvad uurimisgrupid

1) Mikrolainetehnika uurimisgrupp (Microwave Engineering Research Group), juht: emeriitprofessor Andres Taklaja

Objectives of the Microwave Engineering Research Group are designing, prototyping, laboratory and field testing of military radiocommunications jamming devices and Radio-Controlled Improvised Explosive Devices (RCIED) neutralizing devices.

The research group continued the development of RCIED neutralizing devices and methodology for efficient detection and jamming of RCIED control signals. Novel techniques for fast detection of unknown radio signals were developed and tested. A research was continued in the area of jamming of radio communications using antenna arrays. Directivity properties of various types of planar arrays (rectangular, circular etc.) were studied using modeling of the arrays in MATLAB.

Uurimisgrupi olulisemad teaduspublikatsioonid 2013.aastal:

1. Trump, Tõnu; Müürsepp, Ivo (2013). Detection Speed of Responsive Communication Jamming Detectors. E.O. Ahmed, K.Y.Kim, Y. Shang T. Draganova, M. Roushdy and A.M. Salem (Toim.). Recent Advances in Telecommunications (143 - 148). Dubrovnik, Croatia: WSEAS.

2) Signaalitöötluse uurimisgrupp (Signal Processing Research Group), juht: prof. Tõnu Trump

Research at the Signal Processing Research Group is focused on two main areas – adaptive signal processing algorithms and cognitive signal processing and spectrum sensing.

In the area of adaptive algorithms the research continued to focus on combinations of two adaptive filters. When designing an ordinary adaptive algorithm, one faces a trade-off between the initial convergence speed and the mean-square error in steady state. In case of algorithms belonging to the Least Mean Square (LMS) family this trade-off is controlled by the step-size parameter. Large step size leads to a fast initial convergence but the algorithm also exhibits a large mean-square error in the steady state and in contrary, small step size slows down the convergence but results in a small steady state error. The combination of two adaptive filters solves this trade-off by employing two filters that adapt simultaneously on the same input signal.

The spectrum sensing research has been focused on deriving robust detectors for usage in cognitive radio. Teaching Assistant Ivo Müürsepp defended his Ph.D. thesis in this area in October 2013. Detection of speech signal reflections was also investigated.

Uurimisgrupi olulisemad teaduspublikatsioonid 2013.aastal:

1. Trump, T. (2013). On a Combination of M Adaptive Filters. European Signal Processing Conference (EUSIPCO 2013), Marrakech, Morocco, 9–13 Sept. 2013. Marrakech, Morocco: IEEE, 2013, 1 - 5.
Trump, Tõnu (2013). Adaptive Filter Combinations (Plenary Lecture). 2nd International Conference on Circuits, Systems, Communications, Computers and Applications (CSCCA '13). Dubrovnik, Croatia, 2013, 12 - 12.
2. Trump, Tõnu; Tart, Allan (2013). A Dual Filter Scheme for Secondary Surveillance Radar Reply Signals. E.O. Ahmed, K.Y. Kim, Y. Shang T. Draganova, M. Roushdy and A.M. Salem (Eds.). Recent Advances in Telecommunications (149 - 154). Dubrovnik, Croatia: WSEAS.
3. Tart, A.; Trump, T. (2013). Adaptive Equalizer for Mode S Receiver. 8th International Workshop on Systems, Signal Processing and their Applications (WoSSPA), Mazafran, Algiers, Algeria, 12-15 May 2013. IEEE, 2013, 277 - 282.
4. Trump, T. (2013). Applications of a combination of two adaptive filters in Adaptive Filtering. L.G. Morales (Ed.). Adaptive Filtering - Theories and Applications (61 - 89). InTech - Open Access Publisher.
5. Trump, T. (2013). Detection of consistency of two speech signals using pitch periods. Proceedings of the Estonian Academy of Sciences, 62(2), 88 - 96.

3) Kasutajaliideste uurimisgrupp (Man-Machine Relationship Research Group), juht: dots. Toomas Ruuben

Research activities of the group have been focused on two main areas – intelligent perception support and decision support in military conditions.

The research group is working on integration of path planning algorithm (realized in MATLAB environment) into Google Map-based application. Situation aware route planning can be used for improving route planning tasks in urban military operations. Unlike

conventional route planning tasks that are usually used for finding shortest routes, research group approach uses multiple parameters and categories for describing asymmetric threats emanating from surrounding urban environments and planning routes. These parameters can be combined together to find routes with different properties. Multiple tests were performed using A* and genetic algorithm to present how different parameter values and their combinations affect output routes and how different threats can be avoided by taking those parameters into account. Tests showed that both algorithms can be used for route planning, but A* would be the recommended choice, because the probability of it finding the global optimum is larger.

Uurimisgrupi olulisemad teaduspublikatsioonid 2013.aastal:

1. Ruuben. T., Kreison, O. (2013). Route planning in asymmetrical military environment. Second International Conference on Future Generation Communication Technologies (FGCT 2013). December 12-14, 2013. City Conference Center, Holborn, London.

2.2 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustest.

Rahvusvahelised tunnustused puuduvad.

2.3 Loetelu struktuuriüksuse töötajatest, kes on välisakadeemiate või muude oluliste T&A-ga seotud välisorganisatsioonide liikmed.

Prof. Tõnu Trump – IEEE vanemliige (Senior Member)