

**Subject:** Application of Game theory in wireless multi-hop networks

**Research Focus/  
Cross-sectional Area:** R9) Communication systems



**Description:**

Topic of the thesis is the application of game theoretical approaches in wireless multi-hop networks. In such networks, questions like which node shall forward the data and how to divide the bandwidth and power among the different nodes need to be answered. A traditional approach is to formulate an optimization problem to achieve a certain network objective like maximizing the sum rate and then try to find the optimum solution or a suboptimum solution. The optimization problem needs to be solved by a centralized unit that knows all the system information and then informs all nodes through feedback channels about the allocated resource profiles. The second approach is to formulate a game and use the game theory framework to study the interaction among selfish players or nodes, respectively. The solution to the formulated non-cooperative game is the Nash Equilibrium (NE) which is the strategy that no player gains by changing only his own strategy unilaterally. The NE solution can be found in a distributed manner. The interactions among the nodes are captured using utility functions which have to be chosen properly. Furthermore, incentive mechanisms need to be investigated as a NE not always leads to the solution with the highest social welfare.

**Requirements:**

Excellent Diploma or MSc in EE & IT or related area; excellent background in communications engineering, signal processing, mathematics, programming and simulation in Matlab, C++; good knowledge of German and English languages

**Supervisors:** A. Klein, Communications Engineering,  
N. N.