Poster Session:

Chairmen: M. Lemmel (DE-Bremen), Th. Rauschenbach, Ch. Ament (DE-Ilmenau)

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Pilot-modular robot navigation for real-world-applications
Accomplishing navigational tasks like path planing, obstacle avoidance and motion planning are essential capabilities for autonomous mobile robots allowing them to offer more complex services. The E*-algorithm and the Dynamic Window Approach (DWA) have emerged as a de facto standard for path and motion planning. Based on these algorithms we present a generic and flexible solution of robot navigation that is applicable for both holonomic and non-holonomic robots. We propose a number of improvements and extensions that help to overcome some limitations of the original implementations and that are required for robots in daily operation. We introduce an adaptive Dynamic Window that allows a fine-grained control of the robot's actuators enabling the system to navigate with a high precision while reducing the computational complexity. The reduced complexity permits us to implement a novel multi-stage local planning method using cascaded Dynamic Windows that is able to plan more than one action of motion ahead. This multi-stage planning is needed by non-holonomic robots in order to get out of dead-end situations. Moreover, we present a combined topological E* path planner that allows path planning across multiple maps and therefore enables the application in buildings with different floors. We show how our solution can be used for a large variety of navigational tasks that reach from random exploration to more complex tasks like navigation to a given target, precise docking at a docking station or following a moving person. Finally, we prove the robustness of our concepts with long-term tests in different real-world scenarios like home improvement stores, supermarkets and fast food restaurants.

O. Katernoga, O. Shabrov (BY-Minsk)

Study of stability analysis of control system for devices of mobile telecommunications
The design of digital radio receiving systems (DRRS) of persistent signals, receiving signals from moving objects is considered. First, we analyzed of stability of the system. Input DRRS signal comes from the antenna output or amplifier of a high or intermediate frequency with different modulation formats. The system produces not only filtering and demodulation of analog narrow-band signal, but also the primary digital processing of extracted information through the ADC. DRRS in the GPS gives the results of evaluations of current navigation parameters; synchronization and demodulation of carrying oscillation; synchronization and demodulation of subcarriers and modulating them ranged harmonic oscillations; synchronization and demodulation of binary characters; measuring of the signal parameters in order to obtain tracking data and evaluate the receiving quality. Systems must have high noise immunity to work in conditions of intentional interference by suppression of

narrowband station interference at minimal spectrum distortion of the receiving signal. Engineering calculation of digital closed systems of synchronization can be performed using quasicontinuous model consisting of the discriminator block and the linear part block with transfer function, which is the product of the transfer functions of a digital filter and digital synthesizer. The discriminator model consists of a differential part, a nonlinear part with a discriminatory characteristic, and the summation part, which receives the white noise and represents a circuit with constant parameters. We use the general theory of root trajectories in control of continuous systems. For the stability analysis of discrete systems the method for data control systems with time delay was applied. We designed the mathematical models of discrete systems in the form of analytical equations of the functional root godograph, which consider the form of modulation, nonlinearities of elements, ADC, the delay and distributed parameters. Geometric criteria for evaluation of the absolute stability of systems are developed. A computer-oriented method of stability analysis systems of regulation for radio receivers of mobile communications is proposed. The noise immunity of navigation receiver of complex signal is investigated.