DESIGN AND CONTROL OF A GYRO STABILIZED PAN-TILT SENSOR SYSTEM FOR MOBILE APPLICATIONS

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Introduction. Pan-tilt platforms are the motion control systems mostly used for controlled positioning of various devices (video cameras, sensors, antennas) in mobile applications such as aerial video surveillance systems, mobile robots for emergency situations, space rovers, defense modules and many others. In this project, a spherical parallel manipulator (SPM) platform is studied for designing a 3DOF system of pure rotation for optimal platform orientations suitable for mobile applications. An optimal trajectory generation and an orientation stabilization control systems will be designed using Model Predictive Control techniques and implemented on the platform prototype.

Materials and methods. A spherical parallel manipulator platform was designed in SolidWorks CAD mechanical design software and manufactured as a 3D printed prototype for experimental analysis of the system. A forward and inverse kinematics of the SPM were fully analyzed and utilized for control system design purposes. The reachable SPM workspace was defined for the developing its optimal control taking into account singular configurations and mechanical interferences of the manupulator links.

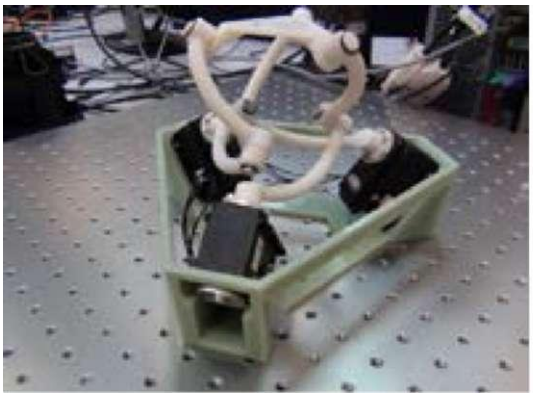

Figure 1. A 3D printed SPM prototype.

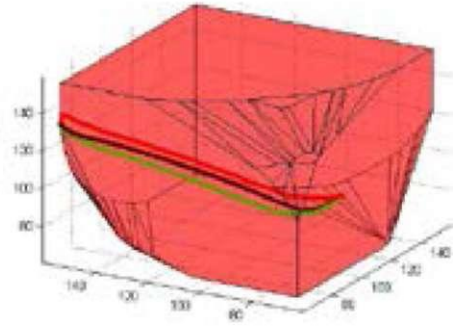

Figure 2. An example of the SPM top platform trajectory in the modeled system workspace.

Results and discussion. An approach for obtaining a unique kinematic solution of SPM was developed. This approach can be applied to SPMs with different geometries and will be used for designing manipulator real-time control systems. An optimal control is implemented on a 3D printed SPM prototype for minimum time trajectory generation. More information and accompanying video can be viewed at www.alaris.kz.

References.

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