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TIM: A FORMATION OF SMALL SATELLITES FOR PHOTOGRAMMETRIC EARTH
OBSERVATION**Abstract**

A formation of cooperating pico-satellites enables observation of target areas on the Earth's surface from different viewing angles. This way three-dimensional surface maps are generated by photogrammetric methods and application of sensor data fusion approaches. Application potential addresses characterisation of ash clouds from volcano eruptions, damages after Earth quakes, growth of city limits, ships on sea, ...

This contribution addresses the cooperative control of this distributed space system, preliminary CubeSat system design and the payload design in order to perform joint observations. The technology base focusses on networked control algorithms, using inter-satellite links and relative navigation approaches. Challenging aspects address in particular attitude and orbit control system at the size of a 3U CubeSat in order to enable an appropriate pointing accuracy. For this purpose, miniature reaction wheels have been developed with specific high rotation speed as essential element of the attitude control system. The input precision for fine pointing of the control systems is achieved by using feature extraction from observation data. Additionally, one of the TIM satellites houses an optical link to the ground, demonstrating the capability of a high-bandwidth downlink. The concepts for testing related performances on ground by employing high precision turntables are addressed.

The Telematics International Mission TIM integrates similar satellites from international partner institutions from 5 continents. Thus careful control interface and intersatellite link specifications is the basis for the cooperation in orbit for joint Earth observation.