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AUTOMATIC SCHEDULING SYSTEM FOR SAR SATELLITE CONSTELLATION

Abstract

Today, the commercial space industry is growing at a pace never seen before. Many companies as well as agencies are building their own earth-observing satellite constellations to provide some specific services to users and customers. Managing the optimum work schedule and operations of a satellite constellation on a regular basis is very complex. So, an automated task scheduling system for such constellations became a basic need for the owners and operators. As most of the satellites can only do one thing at a time, to derive an optimum work schedule, the software needs to balance between the imaging tasks and ground contacts while maintaining various constraints, like power budgets and the limitations of different hardware. This paper describes the automatic mission planning and task scheduling system used in iQPS to maintain our constellation of multiple SAR satellites. As a commercial satellite service provider, our company's operation is highly focused on our customers' demands. This is also reflected in the design philosophy of our scheduling system, which provides a hybrid method for requesting SAR observation that is not covered in most of the literature on this topic. It enables the customers to either select the exact time of observation (Fixed-mode) or simply specify a preferred temporal window (Flex-mode) along with the target location when requesting. Apart from managing the imaging requests, this single system also creates schedules for ground contacts. It has access to all our antenna resources- both our own and of third-party providers. Based on all contact opportunities and existing imaging requests, it continuously maintains the optimum ground contacts and creates low-level satellite commands for all these tasks, including automatic downlinks initiated by the satellite itself. So, the human operator just needs to uplink the commands during ground contacts, which is also done by an automatic agent in most cases. This scheduling system currently uses a static power model to deal with the battery budget of different components, which greatly simplifies the process. Detail of this modeling is presented in this paper. It also uses a static agility model to ensure the minimum transition time required between successive pointing tasks. Lastly, the system uses a novel, customer-oriented scoring system to select the optimum work schedules for Flex-mode requests. This scoring system and its associated scheduling algorithms are also described in the paper and compared against some other existing algorithms.