September 2014

SOFTWARE TECH BRIEFS

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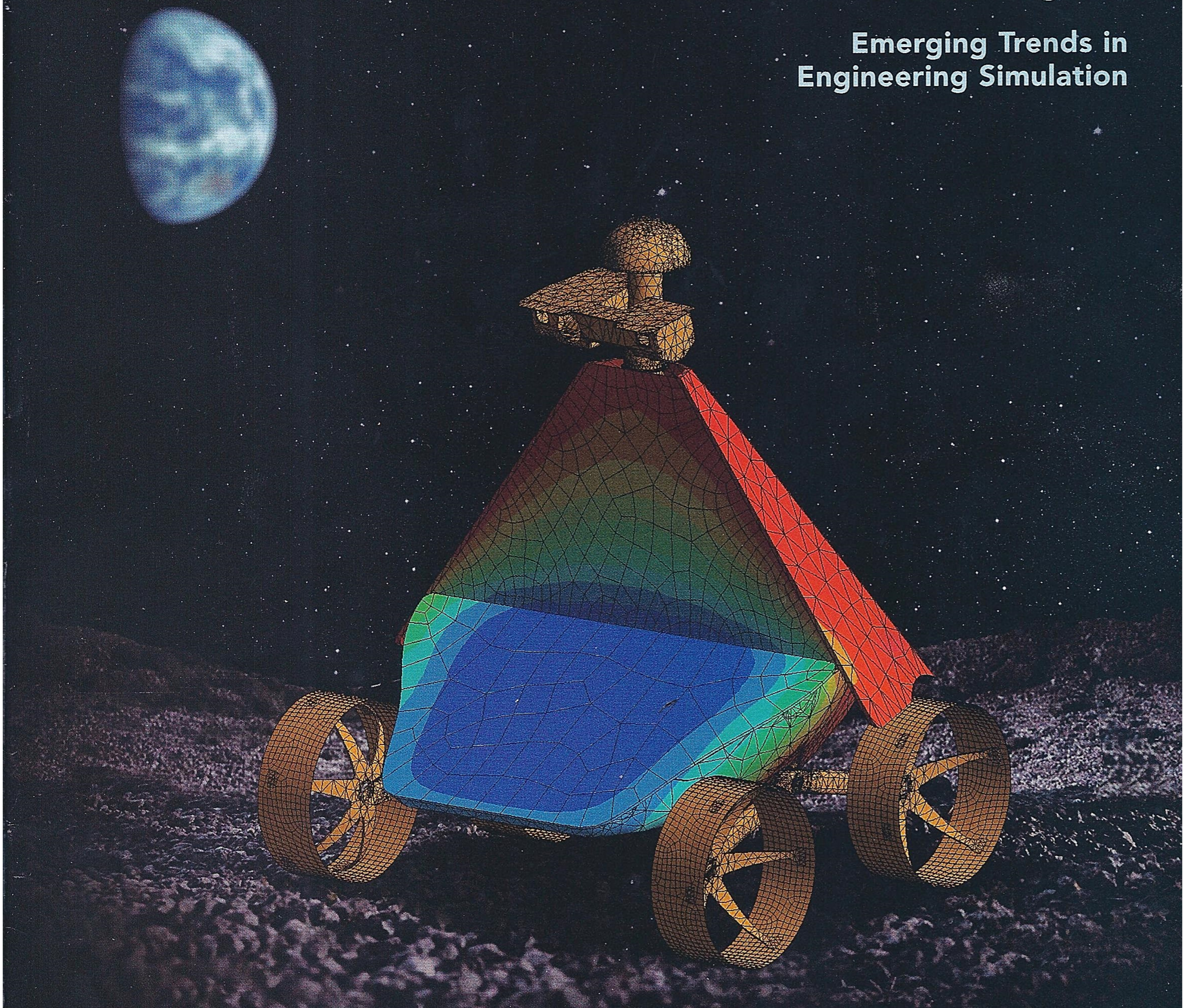

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consideration is novel. Further, the notion of automatic rover localization against orbital imagery is novel.

This work, if matured and deployed, will dramatically reduce the man-hours required for rover localization, and reduce the need for expert oversight in this process. Further, it provides concrete metrics on match accuracy instead of a subjective evaluation.

This work was done by Adnan I. Ansar of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.

The software used in this innovation is available for commercial licensing. Please contact Dan Broderick at Daniel.F.Broderick@jpl.nasa.gov. Refer to NPO-49178.

SAM/MSL Terrestrial Background Spectral Library

Goddard Space Flight Center, Greenbelt, Maryland

The SAM/MSL Terrestrial Background Spectral Library is one of the tools developed for identifying known terrestrial background for the Mars Science Laboratory (MSL) Sample Analysis at Mars (SAM) mission. The SAM instrument suite can detect trace elements in the ppb range and therefore requires a robust library and informational structure to aid it in identification of source origin. It is unique in that it is the first spectral library developed containing spectra of more than 800 gas chromatography mass spectrometry (GCMS) files generated from analysis of actual rover materials. The terrestrial background library will help ensure that the spectral identifications remain accurate, and also determine whether the spectra arise from the Mars or Earth environment.

The development of an organic terrestrial background library allows for the identification of compounds found on Earth that would be inadvertently detected in the Mars soil and gaseous samples as impurities. As such, this library will prove useful for the SAM instrumentation analysis on Curiosity Mars Rover.

The process of analyzing an unknown GCMS data file begins by performing a similarity and identity search using mass spectral analysis software [AMDIS (Automated Mass Spectral Deconvolution and Identification System), IFD (Ion Fingerprint Deconvolution, ACD (Advanced Chemistry Development)]. The most likely spectrum of one kind of search is compared with the one from the other type, and the most probable compound identity determined.

IFD software is utilized to identify and select the most significant total ion chromatogram (TIC) peaks. The spectrum for each of the peaks identified in the NIST TIC peak search is obtained and exported into a standard NIST text library file. The NIST Search Library is used to read the spectrum and obtain information regarding the most likely compound to match the spectrum.

One goal of the contamination control plan is to have prior knowledge of the materials used, especially those that occupy large areas of the GSMS data space and produce multiple GCMS peaks. To achieve this, a materials testing program has been put in place. GCMS data is collected from organic-releasing materials used on the exterior of the rover and for materials used in large quantities in the interior.

This work was done by Prabhakar Misra, Raul Garcia-Sanchez, Paul Mahaffy, and Doris Jallice of Goddard Space Flight Center; and John Canham of ATK Spacecraft Systems and Services. ***For more information, download the Technical Support Package (free white paper) at www.techbriefs.com/tsp under the Software category.*** *GSC-16547-1*

Efficient Spectral Endmember Detection Onboard Spacecraft

Hyperspectral image analysis is useful for remote sensing or industrial applications, such as automated detection of manufacturing defects or food safety inspection.

NASA's Jet Propulsion Laboratory, Pasadena, California

Spaceflight and planetary exploration place severe constraints on the available bandwidth for downlinking large hyperspectral images. Communications with spacecraft often occur intermittently, so mission-relevant hyperspectral data must wait for analysis on the ground before it can inform spacecraft activity planning.

A future generation of hyperspectral imagers, such as HyspIRI, will return unprecedented volumes of image data; communication bandwidth constraints and latency will be a key constraint on the total data yield. A similar issue confronts planetary exploration missions that must communicate with Earth over the Deep Space Network. Endmember detection can improve mission science return in both cases. It permits more sophisticated analyses, such as novelty detection, change detection against historical catalogs, scene summary, and data reduction prior to onboard classification to find specific targets of interest. Additionally, endmember analysis can facilitate data summary for downlink. The technology described is suitable for use with onboard hyperspectral instruments and/or their host spacecraft. An efficient superpixel-based endmember detection algorithm keeps to the limited computational constraints of spacecraft flight processors. EO-1 (Earth Observing One) flight experiments demonstrate that the procedure enables significant improvements in downlink efficiency.

While the implementation of both Felzenszwalb graph segmentation and SMACC (Sequential Maximum Angle Convex Cone) endmember detection algorithms is straightforward, additional optimizations were necessary to fit within