



Physical Sciences

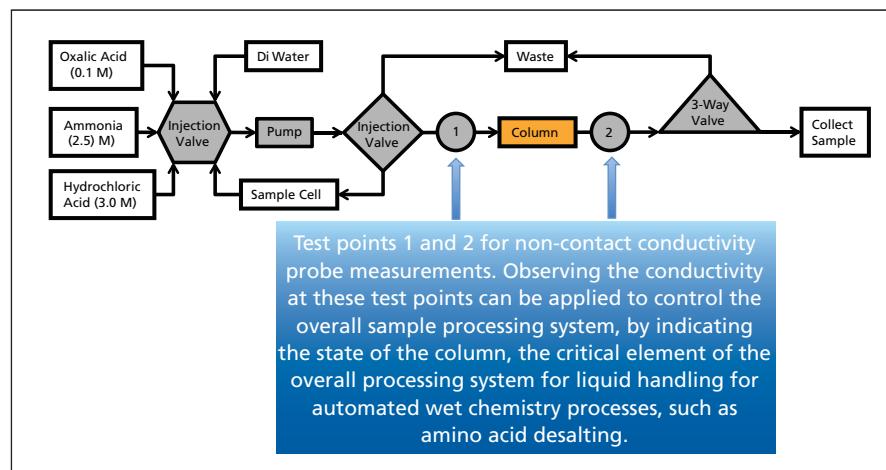
Non-Contact Conductivity Measurement for Automated Sample Processing Systems

Conductivity probes are used to control the process.

NASA's Jet Propulsion Laboratory, Pasadena, California

A new method has been developed for monitoring and control of automated sample processing and preparation especially focusing on desalting of samples before analytical analysis (described in more detail in "Automated Desalting Apparatus," (NPO-45428), *NASA Tech Briefs*, Vol. 34, No. 8 (August 2010), page 44). The use of non-contact conductivity probes, one at the inlet and one at the outlet of the solid phase sample preparation media, allows monitoring of the process, and acts as a trigger for the start of the next step in the sequence (see figure). At each step of the multi-step process, the system is flushed with low-conductivity water, which sets the system back to an overall low-conductivity state. This measurement then triggers the next stage of sample processing protocols, and greatly minimizes use of consumables.

In the case of amino acid sample preparation for desalting, the conductivity measurement will define three key conditions for the sample preparation process. First, when the system is neutralized (low conductivity, by washing with excess de-ionized water); sec-



This System provides a new method of monitoring and control of automated sample processing and preparation.

ond, when the system is acidified, by washing with a strong acid (high conductivity); and third, when the system is at a basic condition of high pH (high conductivity).

Taken together, this non-contact conductivity measurement for monitoring sample preparation will not only facilitate automation of the sample prepara-

tion and processing, but will also act as a way to optimize the operational time and use of consumables.

This work was done by Luther W. Beegle and James P. Kirby of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-47411

An MSK Radar Waveform

An increase in radar resolution results without the need for additional spectrum.

NASA's Jet Propulsion Laboratory, Pasadena, California

The minimum-shift-keying (MSK) radar waveform is formed by periodically extending a waveform that separately modulates the in-phase and quadrature-phase components of the carrier with offset pulse-shaped pseudo noise (PN) sequences. To generate this waveform, a pair of periodic PN sequences is each passed through a pulse-shaping filter with a half sinusoid impulse response. These shaped PN waveforms are then offset by half a chip time and are separately modulated on the in-phase

and quadrature phase components of an RF carrier. This new radar waveform allows an increase in radar resolution without the need for additional spectrum. In addition, it provides self-interference suppression and configurable peak sidelobes.

Compared strictly on the basis of the expressions for delay resolution, main-lobe bandwidth, effective Doppler bandwidth, and peak ambiguity sidelobe, it appears that bi-phase coded (BPC) outperforms the new MSK wave-

form. However, a radar waveform must meet certain constraints imposed by the transmission and reception of the modulation, as well as criteria dictated by the observation. In particular, the phase discontinuity of the BPC waveform presents a significant impediment to the achievement of finer resolutions in radar measurements — a limitation that is overcome by using the continuous phase MSK waveform. The phase continuity, and the lower fractional out-of-band power of MSK, increases the al-