

# Rarely Asked Questions

Strange stories from the call logs of Analog Devices

## Impedance Measuring Chip Offers Little Resistance to Applications

**Q:** I came across your Impedance measuring chip (IMC) in a recent article. It sounds interesting, but how does it work and what can it be used for?

**A:** The impedance measuring chip you mention is an extremely versatile device with countless practical applications.

Able to measure complex impedances from  $100\Omega$  to  $10M\Omega$  with 0.5% accuracy, the IMC is a marvelous example of integration, elegance and practicality. The IMC comprises a direct digital synthesis (DDS) frequency generator, a 12-bit analog-to-digital converter (ADC), and a digital-signal-processing (DSP) engine.

The frequency generator provides a voltage stimulus to the device under test (DUT) at frequencies between 1 kHz and 100 kHz, and the ADC samples the resultant current. The DSP performs a discrete Fourier transform (DFT) on the digitized signal, and produces real (R) and imaginary (I) data words at each frequency. Using this information, the magnitude and phase can be calculated along any point in the frequency sweep.

Limited only by the imagination, some applications for an IMC include virus detection, blood coagulation monitoring, electro-impedance spectroscopy, and loud-speaker optimization.

Different virus strains cause different chemical reactions in blood. Characterizing these reactions by measuring their impedance over frequency enables researchers to identify different virus strains by their impedance signature.



Blood clotting time can be determined by measuring the impedance as it coagulates. Crucial to recovery of heart bypass patients, monitoring coagulation enables doctors to maintain a balance between bleeding and clotting.

Electro-impedance spectroscopy uses impedance to measure corrosion of aluminum and steel in infrastructure, cars, planes, and ships, preventing early failures and unneeded repairs. Impedance measurement chips can be placed in remote, hard to reach spots. This constant "structural supervision" signals maintenance crews to the first sign of corrosion or premature wear.

Measuring speaker impedance across the audio frequency range enables designers to actively match the speaker impedance to the audio driver for optimal performance and power transfer.

It's almost maple sugar season here in New England. I wonder if an IMC could measure the sugar content of the sap... hmmm, I'll have to look into that.

**To Learn More About Impedance Measurement Applications**

<http://designnews.hotims.com/23098-100>



**Contributing Writer**  
John Ardizzoni is an Application Engineer at Analog Devices in the High Speed Linear group. John has been with Analog Devices since 2002, he received his BSEE from Merrimack College in N. Andover, MA and has over 29 years experience in the electronics industry.

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[raq@reedbusiness.com](mailto:raq@reedbusiness.com)

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