Piezoelectric Polymers as Haptic Engines

Preface: Thanks to Francois Jeanneau, CEO and Sri Peruvemba, VP of Marketing from Novasentis for contributing the source information in this post.

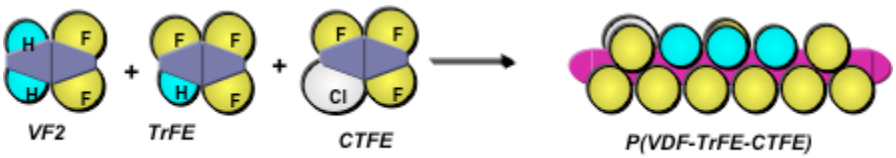
There isn't any technology that is safe from the march of time and progress. Very little of the early days of mobile phones and mobile devices remains today. Even the venerable and effective 3.5mm audio jack is going to meet an ignominious end. Unlike the audio jack (which I am very sad to see go), the vibrator in a cell phone is holding strong. To be honest, it is an effective technology, an off-center weight at the end of a small DC motor. Its longevity has been a testament to its simplicity. The eccentric rotating mass (ERM), as those of us who are prone to fits of pedantry call it, remains limited in its functionality and features. It is time that someone came up with something that advances the science of haptic feedback and also maintains the core functionality of the technology. Novasentis has done just that by creating an effective piezoelectric polymer haptic device.

Move Aside ERM, Make Way for EMP

No, not electromagnetic pulse (EMP), sadly. Novasentis has created a new class of haptic actuators, using Electro-Mechanical Polymer (EMP) technology, that is extremely light, paper-thin (150 microns), and provide a wide variety of effective haptic outputs from low frequency (a few Hz) to high frequency (KHz). Novasentis has partnered with KEMET to manufacture its actuators in high volume, to support demand from leading consumer electronics OEMs.

Piezoelectric Polymers (Warning: Science!)

In an unpowered state, the molecular structure of the EMP film is randomly aligned. Upon the application of a bias voltage, the molecules align in one direction and expand, creating a piezoelectric effect. EMP actuators are created when this material is bonded to a rigid substrate. When powered, the uni-directional expansion of the material causes the substrate to vibrate, thus, creating haptic feedback at low frequencies and audio feedback at higher frequencies. EMP products have a unique blend of strain and modulus, making them well suited for a multitude of applications.



What does KEMET have to do with all this, you ask? Well, it is simple. If you look at the structure of an SMT film capacitor it is just a stack of polymer film layers with electrodes going to alternate ends. Novasentis owns the engineering of the piezoelectric actuators and the relevant expertise and KEMET has the manufacturing know-how.

Advanced Haptic Response: More Than Just a Simple Buzz

The Novasentis EMP (man, that sounds cool) actuators act as a haptic skin for devices, capable of providing both localized (personalized) and meaningful haptic feedback. ERMs fall well short of meeting both features.

The wide bandwidth of the devices coupled with some science on the physiology of touch and sensation allows for very innovative haptic response rather than the simple on/off, buzz or no buzz notifications associated with ERMs. Consider the following:

- Improved wearable notifications: EMP actuators enable hundreds of different haptic alerts to be felt directly on the skin rendering innovative wearable devices more intuitive and effective than ever before. Imagine the myriad of possibilities with devices that help you learn, determine

who's calling, or help you navigate your way through a crowd—all in real-time, potentially unrecognizable to anyone but the user, and without the need for displays.

- Restore the sense of touch: Novasentis EMP technology is making history by providing a sense of touch in the user interface of many consumer electronic devices. In gaming controllers, the haptic sensation enhances the experience to a whole other level, and with EMP actuators being very fast, there is no lag between the visual and haptic sensations. In the case of AR/VR applications, the visual and audio already exist, the heightened sense of touch delivered via EMP actuators, through a variety of outputs, allows the user to distinguish between different objects by touching them and feeling the difference.

By controlling the wave shape, duty cycle, amplitude, and frequency of vibration, sensations that are completely different from just a simple vibration can be created. More on that to come as there is a great deal of science associated with this too.

We Are Living in the Future

An off-center rotating mass. What's cool about that? Haptic technology has been dominated by the ERM for almost two decades now. With a couple of unsuccessful deviations, the ERM has yet to be unseated. The combination of hard work from KEMET and Novasentis (and a little bit of luck) is bringing haptic technology into the 21st century.

You can go to www.novasentis.com to learn more.