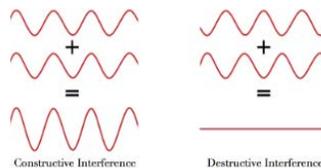


## Application Note #021

### Considering using more than one vibration motor in a device?

Design engineers seeking to use more than one vibration motor to achieve haptic effects or increased vibration force should carefully consider the implications of doing so.

Constructive / Destructive Interference: If more than one motors are running at the same time, unless they are running at the same RPM / vibration frequency, phase and mounted side by side, you will not have pure constructive interference that will result in a larger vibration force.



Harmonics: Vibration motors are not precision motors, and typically have RPM tolerances in the  $\pm 20\%$  range. Because of this no two motors will operate at the same RPM and harmonic frequencies will be generated. These frequencies will be the sum and the difference of these frequencies and multiples thereof. Depending upon the amplitude and frequency, these harmonics may be audible and induce other undesirable effects in the device.

Resonant Frequency of Device: All physical structures have a resonant frequency. If the vibration frequency or any of the resulting harmonics happen to be at the resonant frequency of the device undesirable effects may occur.

Engineers who are seeking to increase the vibrational force in device and want to use more than one vibration motor should consider employing speed / position controllers to ensure all motors are operating at the same RPM / phase. The preferred solution is to simply use one motor with a large G force rating. Engineers seeking to generate unique haptic feedback by employing multiple vibration motors should consider sequencing the motors such that no more than one motor is operational at any given time.