"Magic" digital power sinewaves

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Some newly explored Chebycheff-related algorithms allow the direct digital synthesis of high power, low distortion sinewaves by simple switching of a dc source. Compared to conventional PWM, these "steplock" methods are potentially far more efficient, have significantly fewer switching events, involve much less high frequency energy and greatly minimize EMI. The steplock method offers the unique ability to force ~any~ number of sequential even and odd low harmonics negligibly close to zero.

For exceptionally low harmonic distortion.

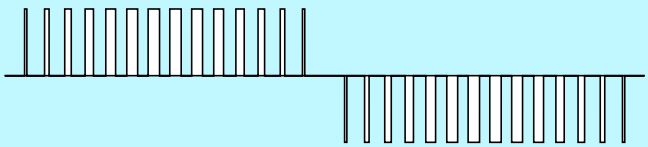
Figure one shows a typical 0.53 amplitude steplocked magic sinewave that uses seven carefully chosen pulses per quadrant. The quadrant pulses are flipped and mirrored to form the entire sinewave. All even and odd harmonics through the twenty eighth are theoretically zero. Using 16-bit PIC table lookup values, the ~total~ achievable THD 2-28 is 0.0027 percent.

That is ~before~ any filtering by motor inductance or load inertia!

Figure two shows a related magic sinewave variation that is fully three phase "delta friendly" compatible. All even and odd harmonics through the twenty second are theoretically zero. A mere ~seven~ table lookup values are required per amplitude.

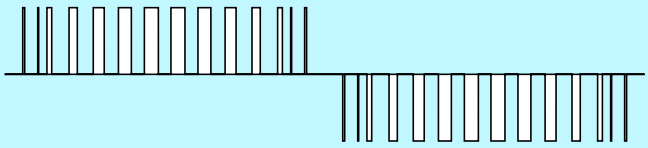
Longer magic sequences of precisely calculated values can zero out dozens or even hundreds of harmonics. These offer very wide motor speed ranges at efficiencies still significantly better than conventional PWM.

JavaScript calculators that let you fully explore these and other magic sinewaves are found at http://www.tinaja.com/magsn01.asp There is no charge for access.



p1s = 11.204229 degrees	p1e = 12.490532 degrees
p2s = 22.452547 degrees	p2e = 24.980665 degrees
p3s = 33.788135 degrees	p3e = 37.468280 degrees
p4s = 45.251639 degrees	p4e = 49.947019 degrees
p5s = 56.878014 degrees	p5e = 62.402492 degrees
p6s = 68.691080 degrees	p6e = 74.808080 degrees
p7s = 80.696403 degrees	p7e = 87.123875 degrees

1. Seven pulse per quadrant steplocked magic sinewave offers an 0.53 amplitude and complete zeroing of all even and odd harmonics 2 through 28. Pulse position and width values must be precisely calculated.



p1s = (60 - p5s) degrees	p1e = (p6e - 60) degrees
p2s = (p7s - 60) degrees	p2e = (60 - p4e) degrees
p3s = (60 - p4s) degrees	p3e = (p7e - 60) degrees
p4s = 36.220282 degrees	p4e = 40.872989 degrees
p5s = 49.843288 degrees	p5e = (120 - p6s) degrees
p6s = 63.995843 degrees	p6e = 71.268717 degrees
p7s = 78.587284 degrees	p7e = 86.459180 degrees

2. Three phase compatible "delta friendly" Magic Sinewave variant also has 0.53 amplitude. Even and odd harmonics 2-22 are zero. A mere seven table lookup values are needed per amplitude.