ALGORITHM DIGITAL DEFINED POWER

Signal Conditioning Through Harmonic Interaction Instead of Suppression

Electrical power is often treated as a stable input to electronic systems. In modern environments, switching power supplies, LED drivers, motor controls, and computing platforms introduce distortion and noise that affect efficiency and signal behavior.

Nonlinear loads draw current in pulses rather than a smooth sinusoidal wave. This introduces harmonic distortion and electrical noise that can propagate across interconnected circuits and shared supply paths. As systems become more dependent on timing accuracy and signal coherence, power quality becomes a question of signal integrity and of how the harmonic structure of the system behaves.

Instead of merely suppressing noise, what if the harmonic components can be manipulated and improved?

HARMONIC STRUCTURE OF ELECTRICAL SIGNALS

Electrical signals can be treated as harmonic systems. A *Fourier series* represents a periodic function as an infinite sum of harmonically related sines and cosines. It acts as a mathematical prism, breaking down complex, repeating waves into individual frequencies.

A periodic complex waveform such as a square wave can be expressed as a harmonic series summation of sine and cosine waves in defined phase relationships. In frequency terms, a square wave corresponds to an odd-harmonic series, including components such as the 3rd and 5th order.

These components interact. They may reinforce, partially cancel, or shift in phase. The fundamental frequency typically contains the largest portion, while higher-order harmonics diminish in amplitude. Despite their smaller magnitude, these higher-order components contribute to the structure and behavior of the waveform.

LIMITS OF CONVENTIONAL POWER CONDITIONING

Established mitigation techniques include *shielding* to reduce radiated interference, *grounding* to stabilize reference potentials, physical separation of conductors, and *filtering* using capacitors, inductors, and transient suppression components. These methods are effective within their intended scope, but they all achieve the same operational goal: suppression. They attenuate, block, or divert unwanted energy after it has entered the system.

At the system level, nonlinear loads continuously generate harmonic distortion and switching-related noise. Even after suppression, the signal environment can remain altered. Noise floors can remain elevated, timing jitter can persist, and sensitive digital logic can exhibit unstable behavior. Conventional methods improve robustness, but they do not directly restore harmonic integrity nor improve the relationships between harmonic components within the system.

ADD POWR APPROACH: HARMONIC INTERACTION

The ADD Powr proprietary algorithm incorporates a low-frequency complex signal with a defined oscillation pattern. Such a signal can be understood as a harmonic structure, composed of sine and cosine components interacting in specific phase relationships.

This framework stems from the foundational work of *Joseph Fourier* (1768-1830), who discovered that complex waveforms can be decomposed into their constituent frequencies. For example, a square wave can be represented as a series of odd-order harmonic sine waves, including components such as the 3rd and 5th harmonics.

Hamonic interaction is facilitated either as a radiated field or a conductive signal.

The **Wizard** and **Sorcer** designs use an amplifier coupled to the secondary of an AC power transformer to induce a small, varying signal onto the primary side. In parallel with the AC line, they generate, propagate, and *radiate* low-frequency electromagnetic fields through a system of coil antennae.

The radiated signal contains a structured set of Fourier harmonics that interact with and saturate signals within the system. When even partial frequency alignment occurs these harmonics resonate with corresponding components in the signal path, such as those present in audio systems, for example.

The Fourier series consists of a fundamental driving frequency and its related harmonic components, often referred to as overtones. These harmonics are sine and cosine waves with varying amplitudes and phase relationships. The fundamental frequency carries the majority of the energy, while higher-order harmonics decrease in amplitude as frequency increases.

A complex pulsed wave disturbance is *conducted* along the AC line. Because it operates at such a low frequency, it isn’t attenuated by typical power supply filtering stages. Instead, this tiny induced signal passes through these filters and is incorporated into the DC reference supply voltage.

What was once a stable DC voltage reference now includes superimposed harmonic components. The reference is no longer purely constant, but it is embedded harmonic sine-wave content.

This represents a significant change in the system's internal reference conditions. What does this mean for signal behavior and system performance, particularly in an audio context?

Real-World Application: Audio Systems

When an audio signal containing substantial energy at around 100 Hz enters an amplifier stage, it is amplified as usual. If the DC supply reference simultaneously contains a harmonic series with a 100 Hz fundamental, *resonance* can occur.

Under these conditions, the altered reference and the input signal share a common frequency component, enabling direct interaction through resonance at that frequency.

In the amplifier, signal amplitude or overall energy will increase. The harmonic series extends upwards across frequencies, effectively to infinity. This allows the modified DC reference in an ADD Powr system to continue harmonically resonating at various frequencies in the music signal passing through the amplifier.

As the audio signal is ultimately emitted through a speaker, a measured decibel (dB) change of 10 – 20% in energy may be observed. This finding is supported by testing across various applications.

MEASUREMENT INSIGHTS AND OBSERVED EFFECTS

To evaluate system-level behavior, measurements were conducted across three categories: electrical response, acoustic response, and real-world application performance.

Electrical response

Fast Fourier Transform (FFT) measurements of amplifier noise floor were taken using a Harman Kardon PA2000 reference amplifier as single-pass observations. Relative to baseline, ADD Powr iterations show increased spectral activity, visible as more pronounced peaks and valleys across a wider range of frequencies.

This indicates greater variation in amplitude across the spectrum, behavior which aligns with increased activity across harmonic bands, rather than uniform suppression of noise.

Figure 1: FFT noise floor comparison, baseline versus ADD Powr

Acoustic response

Acoustic measurements were performed using *IEC-shaped pink noise*, based on international electrical testing standards, as input. Output was measured using an Earthworks M30BX microphone at 0.5 m from a loudspeaker with averaged measurements.

Under identical input conditions, the response shows an increase in output amplitude across 20 Hz to 20 kHz with ADD Powr active. The observed increase is approximately 2 to 3 dB depending on frequency region. Rather than being limited to a narrow frequency band, the increase is distributed across the spectrum.

Figure 2: Acoustic response comparison under pink noise stimulus

System-Level Performance in Gaming Applications

Real-world observations were collected on a system equipped with an RTX 2060 GPU, Ryzen 5 3600 processor, and 32 GB RAM at 1080p resolution. Performance was evaluated across ADD Powr's three optimization configurations: **Wizard**, **Sorcer**, and **Sym I/O**.

Across multiple test scenarios, the following trends were observed:

- Average frame rate increases in the range of approximately 3% to 10% depending on configuration
- 1% low frame rates improved by approximately 5% to 30%, indicating improved frame stability
- Frame pacing reported as smoother or more consistent
- Reduction in stutter under load conditions
- Input latency described as slightly to noticeably improved
- Load times reduced in some cases, particularly where storage and I/O behavior are limiting factors

In specific game examples:

- Rise of the Tomb Raider increased from approximately 75 FPS baseline to 95 FPS under the Wizard configuration
- Borderlands 4 increased from approximately 58 FPS baseline to 70 FPS under similar conditions

The observed changes affect both throughput and consistency. Average frame rate reflects overall output, while 1% low performance and frame pacing reflect stability and responsiveness. Together, these factors define perceived smoothness in interactive applications.

Different configurations also show distinct behavior characteristics:

- **Wizard** produced the most noticeable increases in frame rate and responsiveness
- **Sym I/O** produced improvements in consistency, reduced stutter, and improved data flow
- **Sorcer** showed comparatively smaller changes under the conditions tested

These results indicate that system performance is influenced at multiple levels, including processing, data transfer, and response timing.

Interpretation

Across electrical, acoustic, and gaming measurements, the system shows increased spectral activity, increased output response, and improved stability under dynamic load.

These observations are consistent with a model in which system behavior is influenced through structured harmonic electromagnetic field interaction rather than simple suppression.

CONCLUSION: ADD POWR, A NOVEL APPROACH TO SIGNAL CONDITIONING

Modern electrical systems are increasingly affected by harmonic distortion and electrical noise introduced by *nonlinear loads* and power-electronic devices. Conventional mitigation methods reduce unwanted energy, but they do not restore harmonic integrity or address harmonic relationships within the system.

ADD Powr offers a fundamentally different signal-conditioning approach focused on harmonic interaction rather than suppression. By introducing structured low-frequency activity into the electrical environment and influencing system reference conditions, it seeks to modify how signals behave at a system level.

The observed changes in stability, spectral response, and overall system behavior suggest a meaningful shift in how these systems operate under dynamic conditions, supporting further exploration of harmonic interaction as a viable and groundbreaking signal-conditioning approach.

Glossary

- *Fourier, Joseph:* a French mathematician and physicist (1768–1830) who developed the theory that complex waveforms can be decomposed into simpler sinusoidal components. His work forms the basis for modern signal analysis, including the understanding of harmonics and frequency-domain behavior.

    - *Fourier Series:* a mathematical method that represents a periodic waveform as a sum of sine and cosine waves at different frequencies, amplitudes, and phases.
    - *Fast Fourier Transform (FFT):* an efficient computational algorithm used to convert a signal from the time domain into the frequency domain, allowing analysis of its harmonic content.

- *grounding*: a safety and performance feature that provides a low-resistance path for stray electrical current to discharge into the earth, helping stabilize system voltage reference.
- *harmonic*: frequency component that is an integer multiple of a fundamental frequency. Harmonics combine to form more complex waveforms.
    - *harmonic series*: a set of frequencies consisting of a fundamental frequency and its harmonics. Together, these components define the structure of a complex signal.
- *nonlinear load*: an electrical device that draws current in abrupt, non-continuous pulses rather than a smooth, continuous wave
- *pink noise:* a test signal in which each octave carries equal energy, commonly used in audio testing because it closely matches how humans perceive sound across frequencies.
    - *IEC-shaped pink noise* - a standardized form of band-limited pink noise defined by international audio testing standards (such as IEC 60268). It is used to provide consistent, repeatable input signals for evaluating and comparing audio system performance under controlled conditions.
- *resonance*: a phenomenon where a system driven at its natural frequency responds with greater amplitude and absorbs energy more effectively
- *shielding*: protecting sensitive components from external fields using a conductive enclosure