

An Advanced Technical Solution Against Feedback



Feedback remains a major challenge for sound professionals, affecting the sound quality of concerts, conferences, and other performances or installations. Despite advancements in digital processing, **existing anti-feedback algorithms have limited effectiveness,** especially in complex acoustic environments, and result in unacceptable degradation when audio quality is paramount.

To address these challenges, **ARTEAC-LAB has developed Antidote®**, a new patented algorithm that redefines the standards of anti-feedback processing. This document first provides a brief overview of existing feedback reduction techniques and their limitations. It then describes the workings of the Antidote® algorithm, evaluates its performance against three criteria, and compares it to commercially available systems

Principles and Limitations of Existing Anti-Feedback Algorithms

Feedback reduction techniques can be classified into three main categories, each with its own advantages and limitations:

Notch Filtering

Reduces the frequencies responsible for feedback by applying notch filters, detecting the emergence of problematic frequencies during operation, or through a preliminary calibration phase. This is the most commonly implemented approach in commercial systems today.



• Avantages: Low computational cost.

• **Disadvantages:** Alters the audio signal spectrum. Reaction time can sometimes be slow.

Frequency Shifting

Slightly shifts the frequencies of the signal to reduce instability caused by acoustic looping. This technique is also implemented in some commercial systems.



Avantages: Effective when the frequency shift is significant.
Disadvantages: Degrades audio quality. Unsuitable for musical applications.

Room Modeling

(Acoustic Feedback Cancelling)

Compensates for acoustic feedback (the contribution of the speaker to the signal picked up by the microphone) by modeling its response using a high-order FIR filter (10,000 coefficients or more for highly reverberant spaces). To our knowledge, the only existing system based on this method is the Bosch LBB1968.



Avantages: No theoretical limit to gain increase or quality compromise (provided feedback is accurately estimated).
Disadvantages: Complex implementation, high computational requirements, significant latency, and risk of instability when feedback is poorly estimated.

Principle of the Antidote® Algorithm

The Antidote® algorithm developed by ARTEAC-LAB combines the benefits of the Room Modeling method without the usual drawbacks associated with this approach. To achieve this, two processing blocks are implemented:

- ► A filter hat estimates feedback through fast convolution with low latency (partitioned into variable-sized blocks) based on the reference signal.
- A patented algorithm that continuously and robustly adapts the filter coefficients (without risk of instability) in response to changes in the acoustic environment and the sound system.



Operation Principle of Antidote®

Performances

Antidote® has been evaluated and compared with various commercial systems based on three criteria:

- 1. Added Stable Gain (ASG): Maximum additional gain before feedback.
- 2. Perceptual Evaluation of Speech Quality (PESQ): Speech quality measurement (ITU-T P.862).
- 3. Reactivity: Time required to suppress instability.

These evaluations were conducted on a test bench detailed in our article presented at the AES International Conference in Le Mans in 2024. The following summary table compares the results obtained with Antidote® to those of six other systems available on the market.

Antidote® solution

Brand	Product	Technology	Maximum ASG	PESQ variation @0dB ASG	PESQ variation @3dB ASG	Reactivity @3dB ASG
N/A	Bypass	None	O dB	+0	N/A	N/A
QSC	Core 110f	Notch filtering	2 dB	+0	N/A	18,72 s
Behringer	FBQ 2496	Notch filtering	2 dB	+0	N/A	10,25 s
dbx	AFS2	Notch filtering	3 dB	+0	-0.25	4,45 s
Yamaha	MRX-7	Notch filtering	3 dB	+0	-0.13	5,18 s
Yamaha	MRX-7	Frequency shifting	3 dB	+0.10	-0.15	Os
Bosch	LBB 1968	Room modeling	9 dB	+0.34	+0.14	Os
ARTEAC-LAB	Antidote®	Room modeling	15 dB	+0.81	+0.25	Os

Field Tests

To evaluate the effectiveness of Antidote® in real-world scenarios across various use cases, we developed a compact and portable functional prototype that can easily interface with any sound system equipped with microphones.

This functional prototype is currently being tested by sound engineers. It has already been evaluated in a wide range of acoustic environments (amphitheaters, churches, concert halls, etc.), including the Stade de France during the closing ceremony of the Paris 2024 Olympic Games.

If you would like to experience it for yourself to assess the potential benefits of integrating Antidote® into your products, please feel free to contact us. We would be delighted to arrange a demonstration session of our prototype.

