Documentation/

Kennedy Adaptive Baseline (KAB)

A Volatility-Adaptive Signal Smoother

R. P. Kennedy
DieArchitekt
ORCID: [0009-0006-3598-0581] (https://orcid.org/0009-0006-3598-0581)
GitHub: https://github.com/DieArchitekt
LinkedIn: https://www.linkedin.com/in/diearchitekt/
MQL5: https://www.mql5.com/en/users/diearchitekt

Overview

KAB is a recursive, volatility-adaptive smoother. It adjusts its gain dynamically based on the ratio between short-term and long-term ATR, enabling it to track directional movement during structured market conditions and suppress responsiveness during chaotic or unstructured volatility regimes.

The primary objective is not to forecast or classify market states, but to provide a regime-aware baseline that requires no manual retuning. Unlike fixed moving averages, KAB conditions its responsiveness on the prevailing volatility profile. This makes it well-suited as a structural reference for systems that must operate differently in trending versus choppy environments, without explicit regime labelling.

KAB is intended for system-level integration rather than discretionary application. It is a tool for shaping price data, not interpreting it.

Note from the Author

This system was developed with a strict commitment to minimalism and structural efficiency. Every line of code serves a functional purpose, and unnecessary complexity is deliberately excluded. The design reflects a foundational principle: maximise results using the leanest possible resources.

The underlying philosophy extends across a broader suite of technical indicators, all engineered with the same emphasis on logical soundness, minimal footprint, and alignment with systemic integrity. Visual clutter, excessive styling, chart objects, or over-annotated outputs, is intentionally avoided. The objective is not aesthetic augmentation, but structural clarity.

This approach is architectural in nature, not in the academic sense, but in a systems-oriented sense, rooted in first principles. The design aims to be consistent with fundamental constraints, physical, informational, and computational.

While this may not align with modern preferences for high-dimensional modelling or aesthetic visualisations, the value lies in its leanness, functionality, and engineering discipline. It does what it was designed to do, and nothing more.

Methodology

KAB employs a recursive filter with dynamically scaled gain. Gain is adjusted in real time using a volatility ratio: the quotient of short-term ATR to long-term ATR. This ratio captures whether recent volatility is expanding or contracting relative to a historical baseline. The resulting smoothing coefficient increases during trend initiation (when short-term volatility accelerates faster than long-term) and decreases or locks during unstable or extreme volatility phases.

For each bar, the following steps are applied:

Volatility Estimation:

- Calculate True Range.
- Update short and long ATR using exponential smoothing.

Gain Scaling:

- Compute the ratio of short ATR to long ATR.
- Multiply by a base alpha to derive adaptive gain.
- Clamp the result to a defined maximum.

Volatility Lock (Optional):

- If the ratio exceeds a defined threshold, freeze the output. No update is applied.

Recursive Update:

- If not locked, apply the gain-scaled update to the previous output.
- Optionally, apply a secondary smoothing pass.

Output:

- Return the resulting value as the smoothed signal.

The filter is recursive, causal, and memory efficient. All responsiveness derives strictly from observed volatility, never from price slope, momentum, or deviation. It maintains no historical buffers and does not require back-calculation. Output depends solely on the current bar and internal state.

This design explicitly avoids mechanisms that rely on forecasting, classification, or signal generation. It is engineered for consistent behaviour across instruments and timeframes, assuming ATR periods are proportionally aligned with market structure.

Emergent Properties & Interpretation

Regime Behaviour

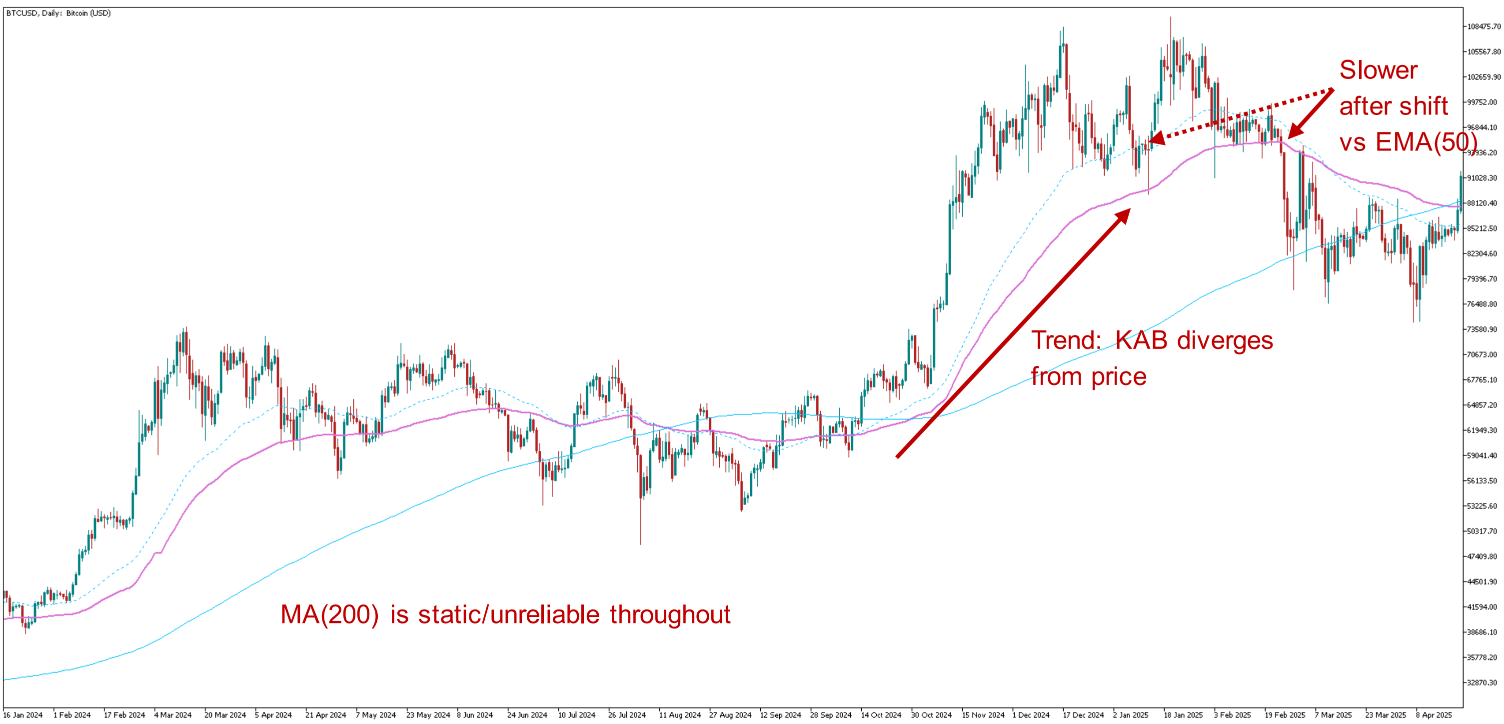
Because KAB's long ATR smooths the short ATR, and both are recursive, the filter introduces persistence into volatility assessments. This results in KAB maintaining a regime state longer than price action alone would imply. In practice, even if price reverses sharply, KAB does not immediately adjust. This reflects implicit regime memory: KAB only responds when the underlying volatility structure materially shifts.

Sensitivity to volatility expansion is non-linear. Since gain is proportional to the ratio of short to long ATR, rather than their absolute levels, KAB becomes highly responsive during regime transitions where short ATR spikes, but long ATR remains elevated. Once both ATRs rise in tandem, the ratio stabilises. Consequently, KAB accelerates during early volatility expansions but attenuates during sustained high-volatility conditions.

When price structure breaks down and volatility spikes, KAB may clamp or flatten, but does not revert immediately upon stabilisation. Recovery is determined by the rate of long ATR compression. The duration of these flat or clamped periods can be interpreted as a soft proxy for regime reset length. This reflects asymmetric responsiveness.

Following an event-driven move, the slope of KAB decays in a predictable manner as ATR normalises. Monitoring slope decay provides a heuristic for determining whether the regime is resolving or remains structurally altered, a crude timing mechanism for system re-engagement post-event.

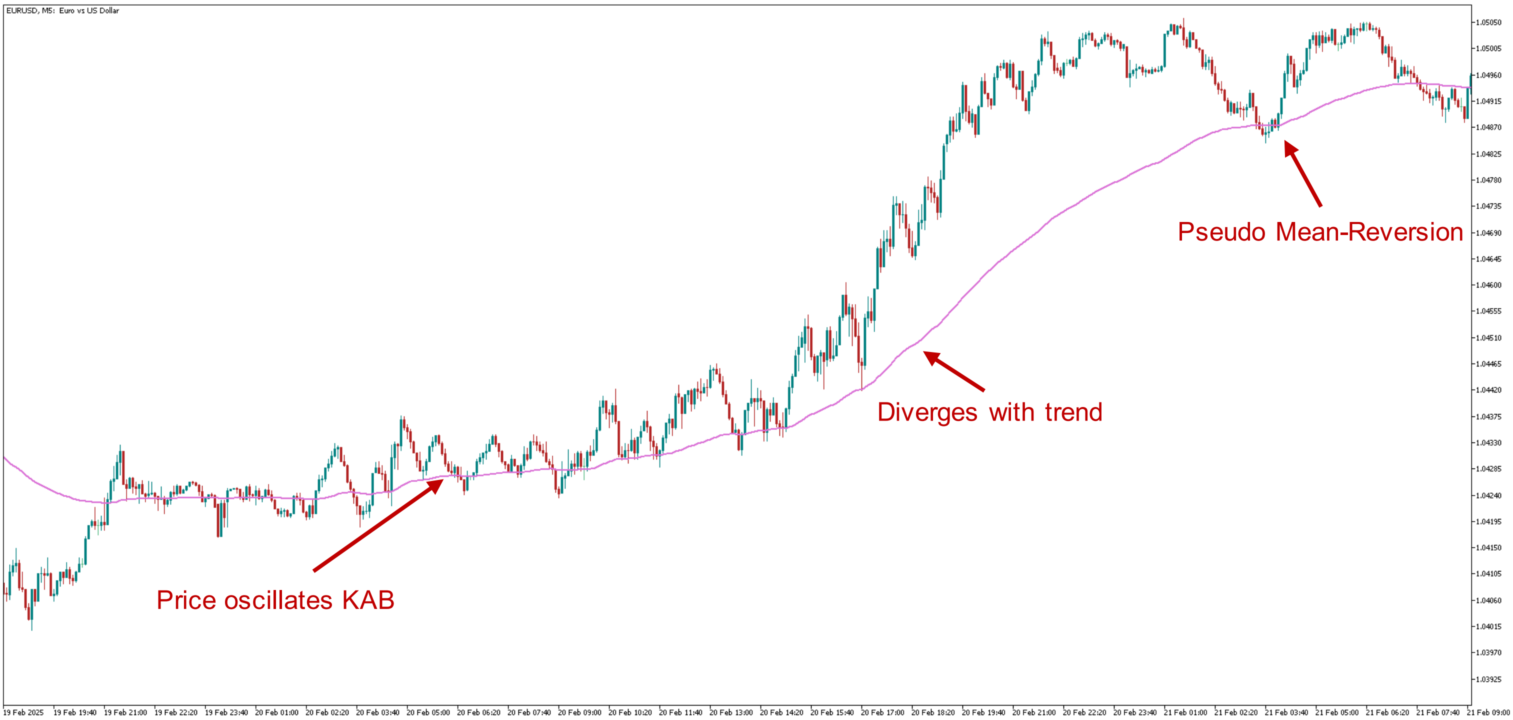
Moving averages such as EMA or WMA respond based on fixed smoothing parameters and are agnostic to regime or volatility state. When price shifts, these averages follow mechanically. In contrast, KAB does not adjust behaviour solely in response to price changes.



Behaviour in Chop

When volatility compresses in both short and long ATRs, KAB effectively anchors. Visually, this manifests as price pseudo-oscillating around a flattened KAB line. Functionally, this behaviour approximates a passive mean-reversion baseline.

Traditional moving averages do not exhibit this anchoring effect. Price can gradually pull such averages up or down, even in the absence of directional conviction. KAB remains flat when the ATR ratio is compressed or locked.



Behaviour in Trends

In stable, directional regimes, short ATR may rise, but long ATR increases proportionally. The ATR ratio stabilises, adaptive gain remains active yet controlled, and KAB updates only within the bounds permitted by volatility. This generates a clear visual separation between price and KAB.

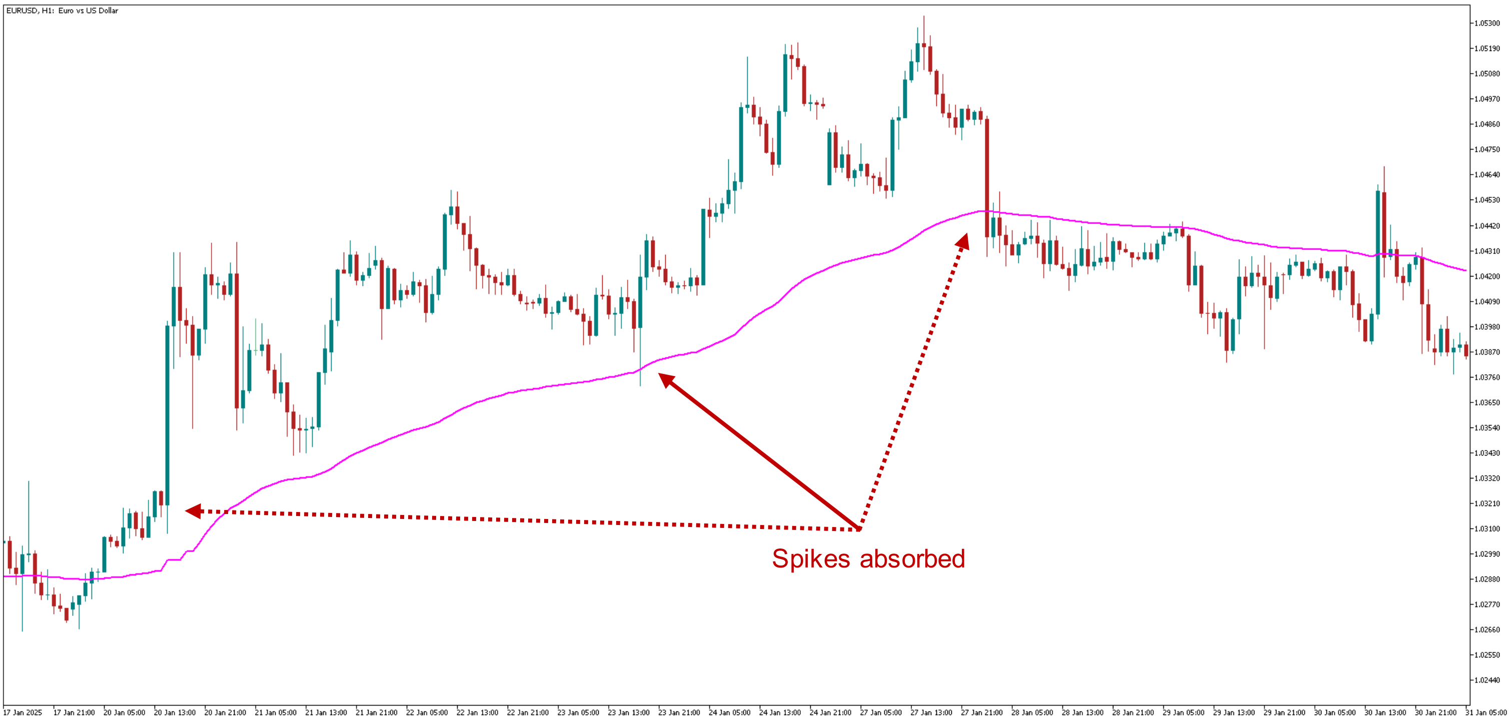
Persistent, one-sided distance between price and KAB acts as a proxy for directional trend strength.

Conversely, when KAB flattens, remains close to price, or price oscillates around it, a non-trend or transitional phase is implied. If KAB is in motion and price consistently leads or lags, this indicates a regime state. The distance between KAB and price becomes an indicator of trend clarity.

Noise Suppression

Short-lived directional moves, even with high magnitude, do not necessarily influence KAB, particularly if short ATR remains unchanged. This enables KAB to filter isolated price spikes selectively.

By comparison, a long-period EMA (e.g., EMA(200)) may ignore an impulse move, not because it recognises noise, but due to inherent inertia. KAB filters impulses based on volatility context rather than fixed lag. If short ATR does not confirm the move, gain remains low.



System Applications & Integration

Trend-Following Systems

KAB functions effectively as a baseline trend reference. Its recursive structure imparts stability, while adaptive gain maintains responsiveness in clean regimes. Persistent positioning of price above or below a rising or falling KAB line serves as a proxy for directional continuity. This behaviour can be used to validate entry signals, qualify directional bias, or suppress low-conviction triggers.

Breakout Systems

KAB serves as a dynamic, volatility-aware midline. Breakout filters based on static moving averages or price extremes may overreact during volatility spikes. During such phases, KAB flattens or locks, enabling the system to delay breakout confirmation until volatility structure aligns with directional continuation. Breakout thresholds can be defined relative to a KAB + ATR envelope or to the absolute price-KAB spread.

Mean-Reversion Systems

KAB's flattening under compression conditions makes it an effective dynamic anchor. When slope approaches zero and price oscillates around the KAB line, conditions are typically favourable for mean-reversion logic. KAB thus serves as both a dynamic mean and a regime classifier. Reversion signals should be disabled when KAB is trending or diverging significantly from price.

Execution-Gating

KAB slope, velocity, or state (locked vs. active) can be used to condition system logic. When slope magnitude is low or volatility lock is engaged, entries can be gated. This suppresses execution triggered by noise in ambiguous regimes. In this role, KAB acts as a structural filter.

Volatility-based Sizing or Throttling

The magnitude of the price-KAB distance, under stable volatility, may be interpreted as a confidence proxy. A large, unidirectional gap suggests strong directional conviction and follow-through; a smaller or oscillatory spread indicates consolidation or potential reversal risk. These dynamics can inform position sizing or system sensitivity.

Compatibility

KAB may replace any static smoothing function in trend-following, channel-based, breakout, or mean-reversion models. It requires no directional assumptions or model-specific calibration. Because it does not impose explicit signal thresholds or directional filters, KAB is non-destructive and can be integrated as a drop-in component.

Cautions & Non-Signals

Price-KAB Convergence

Convergence between price and KAB does not imply reversal. It may indicate volatility collapse, structural pause, or transition to a choppy regime. KAB responds to volatility structure, not directional conviction.

KAB Flattening

Flat KAB output does not inherently signal entry or exit conditions. It indicates low adaptive gain, often due to a stable or ambiguous volatility ratio. This behaviour may occur in sideways markets or following directional moves with collapsing volatility. Flat output reflects structural conditions, not predictive signals.

Price Diverging from KAB

A sustained gap between price and KAB may serve as a proxy for trend strength, but it is not a momentum indicator. KAB does not model acceleration. Divergence reflects stable directional movement within a volatility-supported regime.

KAB Slope

Positive or negative KAB slope reflects smoothed directional behaviour under stable volatility conditions. It does not confirm trend continuation. Slope may persist briefly after trend exhaustion due to ATR memory. It is useful for defining system bias or gating logic but not for timing entries.

Return-to-Price

When price reverts to the KAB line, this does not imply mean-reversion or transition. It may simply reflect volatility contraction or exhaustion of the prevailing directional leg.

Signal Use

KAB is not a standalone signal generator. It does not classify regimes, identify entry points, or mark reversals. Its value lies in constraint and suppression, not in forecast or prediction.

Limitations

Signal Generation

KAB does not produce entries, exits, or regime classifications. All signal behaviours must be defined externally.

Directional Information

KAB is direction-agnostic. It does not differentiate between uptrends and downtrends, nor does it track acceleration or absolute directional strength.

Post-Vol Responsiveness

KAB output may remain flat or suppressed following high-volatility events. Recovery is gated by long ATR compression dynamics.

Input Sensitivity

KAB assumes a continuous, clean OHLC input. It is not designed to handle missing data, null values, or irregular sampling intervals.

Parameter Misuse

Extreme parameter settings can nullify KAB's intended behaviour. Excessively high BaseAlpha, short ATR periods, or disabled volatility lock may reduce it to a conventional moving average.

Scope

KAB is a structural volatility filter. It is not a regime classifier, trend indicator, or predictive volatility model.

Parameter Sensitivity

BaseAlpha

Controls baseline smoothing gain. Lower values increase stability; higher values increase reactivity but may compromise stability. Excessively high settings can override adaptive gain dynamics.

ShortATRPeriod

Determines responsiveness to local volatility. Shorter periods yield faster reactions but may induce premature gain changes. Longer periods stabilise gain but delay regime detection.

LongATRPeriod

Establishes baseline volatility memory. Longer values increase regime persistence. Shorter values enhance reactivity but reduce normalisation effectiveness.

AlphaClampMax

Constrains the maximum allowable adaptive gain. Lower values limit tracking; higher values may introduce instability. This must be greater than or equal to BaseAlpha.

VolLockThreshold

Defines the ATR ratio at which KAB output becomes locked. Lower thresholds induce earlier locking behaviour; higher thresholds allow greater flexibility before locking.

SmoothFactor

Governs secondary dampening. Higher values apply stronger noise suppression at the cost of increased lag. Lower values enhance responsiveness but reduce smoothing.

Benchmarks

KAB is operating as intended when:

- Output flattens or locks during and after volatility spikes
- Slope decays gradually following high-volatility events
- Output remains near-zero slope during compression or chop
- KAB tracks price with lag in directional regimes
- Price-KAB distance compresses in uncertain regimes and expands during clean trends
- Output returns to prior levels during lockout and resumes tracking once volatility ratio falls below threshold

No optimisation is required. Output should be visually and structurally stable across instruments, provided ATR periods are scaled appropriately to the sampling interval.

Engineering Properties

Safe

KAB is structurally inert. It introduces no directional bias, feedback loops, stochastic processes, or thresholds derived from price behaviour. Updates are monotonic, causal, and bounded. It cannot initiate trades or invert system logic in response to transient inputs. Risk arises primarily from misinterpretation rather than misuse.

Reliable

The mechanism is deterministic and fully recursive. Each update depends solely on prior state and the current bar. It requires no recalculation, windowing, or future data. Output remains stable under data stress, and transitions are continuous across volatility regimes. Once deployed, the system requires no recalibration.

Pliable

Parameterisation controls responsiveness, not behavioural class. Tuning affects structural latency and gain dynamics but cannot convert KAB into a signal generator. The filter can be slowed, accelerated, or suppressed, but remains structurally coherent. It adapts to system context without requiring architectural changes.

Efficient

Memory usage is constant: three values are maintained (output, short ATR, long ATR). Computational overhead per update is minimal. KAB is suitable for real-time systems, low-latency execution, and high-frequency evaluation. It requires no historical buffers, sorting operations, or reprocessing steps.

Composable

KAB integrates seamlessly into existing architectures. It does not conflict with trend-following, mean-reversion, breakout, or volatility models. It can replace or augment baseline smoothing components without necessitating changes to strategy logic. Its output aligns with sizing, gating, filtering, and directional bias layers.

Stable Across Assets

Behaviour is consistent across asset classes and timeframes, assuming ATR periods are scaled proportionally to sampling intervals. No asset-specific heuristics or exceptions are required. The volatility ratio structure enables self-normalisation within its smoothing domain.

Transparent

KAB contains no internal opacity. All behaviour is directly attributable to inputs and parameter settings. There are no implicit assumptions or unobservable state transitions. This transparency ensures the system is auditable, explainable, and compliant with internal model governance standards.