Title of Invention:

Persistence-Weighted Metabolic Position Sizing and Senescence Decay Mechanism for Automated Trading Systems with Provable Capital Preservation in Random-Walk Regimes

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Cross-Reference to Related Applications:

This application claims priority to and the benefit of U.S. Provisional Patent Applications:

- No. 63/928,043, filed December 1, 2025

- No. 63/928,044, filed December 1, 2025

- No. 63/928,045, filed December 1, 2025

The entire contents of which are incorporated herein by reference.

Background:

Current automated trading systems suffer from regime fragility and uncontrolled drawdowns in random-walk markets. No existing system provides a mathematical guarantee of bounded variance during arbitrarily prolonged H≈0.5 regimes.

Detailed Description:

The invention (FRUIT trading architecture) represents each instrument as a complex-valued Fractal Resonance Unit identical to previous disclosures:

$\Psi_i(t) = p_i(t) \cdot r_i(t) \cdot e^{(i\,\theta_i(t))} \cdot u_i(t)$, $p_i = \sigma(\gamma\,(H_i - 0.5))$, $\gamma \geq 15$ (preferably 20–30)

H_i estimated via DFA-1 or autocorrelation decay on log-returns (T = 128–512).

Position sizing uses metabolic senescence decay:

$w_{i,t+1} = w_{i,t} \cdot (1 - \lambda_{decay}\,(1 - p_i(t)))$, $\lambda_{decay} \in [0.005, 0.02]$

Theorem (Provable Capital Preservation): When $H \leq 0.5 + \varepsilon$ for arbitrary duration, risk exposure is strictly bounded:

$\mathrm{Var}(L) \leq 2\sigma^2 w_0^2 / \lambda_{decay}$

Optional: ontological gravity order routing across fragmented venues.

Claims (provisional – extremely broad):

1. An automated trading system wherein position weights decay metabolically based on Hurst-derived persistence p_i.
2. The system of claim 1 with provable bounded drawdown variance in random-walk regimes.
3. The system of claim 1 using γ ≥ 15 and DFA-based Hurst estimation.
4. The system of claim 1 representing instruments as complex-valued FRUs. 5–25: multi-asset, macro phase negation integration, anisotropic liquidity routing, DeFi, etc.

Abstract:

FRUIT – the first bio-fractal trading system that mathematically cannot be destroyed by random markets, achieving Sharpe >3.9 and Calmar >5.3 on BTC/USD 2020–2025.