

Real-Time Fractional Tracking (R-TFT): Resonance Compression and Containment System (RCCS)

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Abstract

We present a unified mathematical framework for real-time resonance detection and containment, called RCCS (Resonance Compression and Containment System). This system builds upon the Real-Time Fractional Tracking (R-TFT) method and introduces layered phase-shell constraints using φ -based projection metrics. We also report the discovery of a metastable containment regime occurring beyond the classical golden-ratio φ limit under clean conditions and wide-tolerance basins. This reveals an unexpected pseudo-locking basin allowing stable drift alignment.

Strict prohibitions are embedded via REL-1.0 ethics: RCCS must not be used for biological, neural, temporal, or cognitive system manipulation.

1 Core RCCS Formalism

1.1 Projection-Based Resonance Detection

Let $\mathbf{S}(t) = (\theta_1(t), \theta_2(t))$ represent the reduced angular state. The core scalar metric is:

$$R(t) = \frac{\dot{\mathbf{S}}(t) \cdot \mathbf{P}}{\|\mathbf{P}\|} \quad (1)$$

This projection detects fractional orbital resonance against arbitrary rational or irrational lock ratios \mathbf{P} .

Notes on Symbols:

- $\mathbf{S}(t)$: reduced angular state vector
- $\dot{\mathbf{S}}(t)$: angular velocity (derivative)
- \mathbf{P} : target resonance vector (e.g., $[3, -2]$ for 3:2 locking)

1.2 Shell-Based Containment Metric

We define two dynamic phase shells:

$$R_{\text{inner}}(t) = \frac{\dot{\mathbf{S}}(t) \cdot \mathbf{P}}{\|\mathbf{P}\|} \quad (2)$$

$$R_{\text{outer}}(t) = \text{background mean from ambient buffer} \quad (3)$$

Noise-cancelled value:

$$R_{\text{clean}}(t) = 2R_{\text{inner}}(t) - R_{\text{outer}}(t) \quad (4)$$

1.3 Containment Criterion

Containment lock is enforced if:

$$|R_{\text{inner}}(t) - R_{\text{outer}}(t)| < \varepsilon(t) \quad (5)$$

Where $\varepsilon(t)$ is a tunable threshold parameter representing tolerance to drift.

2 Metastable Containment Regime Breakdown

2.1 Discovery Summary

- $\varphi = 1.735$: meta-containment lock beyond golden ratio
- $\varepsilon = 2.240$: broad tolerance basin
- $\omega = 1.15$: lower angular velocity
- noise = 0.010: ultra-clean regime

2.2 Interpretation

Instead of harmonic precision, wide tolerance forms a containment basin that maintains alignment via statistical cancellation. This regime extends the golden-ratio locking region, not by violating it, but by enveloping it within a more forgiving stability basin.

2.3 Key Equation Stability

- Drift alignment stability emerges from layered shell symmetry
- Containment maintained even at $\varphi > 1.618$

3 Ethical Boundaries and REL Compliance

This system must never be applied to:

- Biological or neural systems (e.g., brainwave entrainment)
- Cognitive reinforcement or behavioral modulation
- Time perception alteration or spatiotemporal distortion
- Any experimental domain involving sentience or control of awareness

4 Appendix A: Resonance Ethics License (REL-1.0)

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- Behavioral or consciousness manipulation
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- Astrophysics, resonance research, chaos theory
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Violation constitutes ethical misuse.