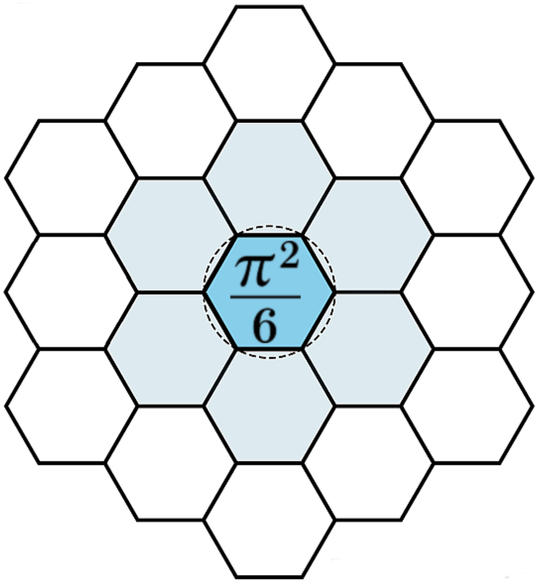
Pattern Field Theory
Tolerance and Constraint-Driven Stability

Structural Series III

James Johan Sebastian Allen
`PatternFieldTheory.com`

January 6, 2026



Abstract

Stability and equilibrium are often described as outcomes of force balance or energy minimization. This paper identifies a more general mechanism: equilibrium emerges through the enforcement of admissible tolerance bounds defined by structural constraints. Systems evolve by shedding unsupported degrees of freedom until their state lies entirely within permitted envelopes. This tolerance-driven settling operates independently of scale, substrate, or representation, and governs stability across physical, dynamical, and symbolic systems.

1. From Footprints to Stability

The preceding paper introduced coherons as stable identities occupying admissible structural footprints. That work established *where* identity can persist. The present paper addresses the complementary question: *why* such footprints enforce stability.

The answer proposed here is tolerance.

Stability is not maintained by continuous correction. Rather, instability removes itself when deviation exceeds admissible bounds. What remains is equilibrium.

2. Admissible Bounds and Tolerance Envelopes

Every stable system implicitly defines a tolerance envelope:

- a maximum admissible deviation
- a minimum admissible deviation

States that remain within this envelope can persist. States that exceed it cannot.

Tolerance should not be confused with precision. Precision specifies an exact value; tolerance specifies a permitted range. Stability depends on tolerance, not exactness.

3. Constraint as the Primary Operator

Constraints do not guide systems toward equilibrium; they eliminate configurations that cannot survive.

This distinction is essential.

> Equilibrium is not selected. It is what remains after non-admissible structure is removed.

Constraint therefore acts as a filter rather than a force. It does not push systems toward a target; it removes degrees of freedom until no further removal is possible.

4. Settling Through Loss of Degrees of Freedom

Instability corresponds to excess degrees of freedom.

As a system evolves:

- unsupported motion dissipates
- non-admissible structure collapses

- deviation along unstable axes vanishes

Settling is the progressive reduction of dimensional freedom until the system lies entirely on its stable manifold.

5. Physical Illustrations

5.1 Liquid Surfaces

A liquid surface under gravity and surface tension explores many configurations while energy is injected. Once energy input ceases, vertical degrees of freedom are no longer supported. Waves decay, curvature collapses, and the surface settles into a flat equilibrium. Flatness is not imposed; it is the only admissible configuration that remains.

5.2 Rotational and Orbital Stability

Wobble in rotating systems dissipates through loss of misaligned components. Stable rotation aligns with principal axes because other modes cannot persist. Similarly, orbital systems shed unstable trajectories, leaving only stable orbits within admissible energy and angular momentum bounds.

6. A Minimal Symbolic Illustration

The same mechanism appears in purely symbolic systems.

Consider an iterative process that:

- enforces extreme admissible configurations
- removes intermediate degrees of freedom
- repeats until no further reduction is possible

Such systems converge to fixed points or small cycles regardless of starting state. The convergence is not numerical coincidence, but tolerance exhaustion.

Kaprekar-type routines provide a minimal, discrete illustration of this principle. The specific numbers involved have no physical meaning; the mechanism they expose is the point of interest.

7. Scale Independence

Tolerance-driven stability does not depend on scale.

The same logic applies to:

- microscopic systems

- macroscopic structures
- symbolic and abstract processes
- continuous and discrete dynamics

Only the admissible envelope matters. The absolute magnitude of values does not.

8. Relation to Coherons

Coherons persist because they occupy footprints whose tolerance envelopes absorb perturbation. Once displacement exceeds tolerance, coherence is lost rather than corrected.

This explains why stable identities appear discrete, resilient, and localized, while unstable configurations dissipate rapidly.

9. Order and the Elimination of Chaos

What is often described as the emergence of order from chaos is more precisely the elimination of chaos by constraint.

Chaos explores possibilities. Constraint decides which possibilities may persist.

Order is not created; it survives.

Conclusion

Equilibrium arises not through optimization or control, but through admissibility. Constraint defines tolerance; tolerance defines persistence. Systems settle because unsupported degrees of freedom cannot survive. This tolerance-driven mechanism operates universally, independent of representation, scale, or substrate. Recognizing it as a primary rule clarifies stability across physical, dynamical, and symbolic systems.

Document Timestamp and Provenance

This document is part of Pattern Field Theory (PFT) and the Allen Orbital Lattice (AOL). It establishes foundational ontology and coheron identity primitives used by subsequent papers in the Expanded Depth Series.