The Minimal Morphism $(()) \Rightarrow () \Rightarrow (())$ in the UNNS Substrate

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Abstract

We investigate the symbolic morphism $(()) \Rightarrow () \Rightarrow (())$ as the minimal recursive transformation within the Unbounded Nested Number Sequences (UNNS) substrate. Using the UNNS Vector Protocol (UVP), this paper interprets the morphism as a closed recursive flow that collapses and regenerates informational structure. We define the algebraic and geometric representation of the cycle, introduce the round-trip fidelity metric, and provide a minimal numerical simulation illustrating convergence, collapse, and reformation in the recursive manifold.

1 Introduction

In the UNNS substrate, recursion depth serves as a discrete analogue of time and structure. The symbol () denotes a stable recursion (an atomic node), while (()) encodes a higher-order recursion that contains its own generative rule. The transformation

$$(()) \Rightarrow () \Rightarrow (())$$

expresses a collapse of recursion into its minimal observable form, followed by regeneration. The process forms a self-consistent loop—an informational analogue to cosmological contraction and expansion, preserving recursion energy through transformation.

2 Vector Representation under the UNNS Vector Protocol (UVP)

At recursion layer n, define the system as a vector:

$$G_n = (g_1^n, g_2^n, \dots, g_{12}^n) \in \mathbb{R}^d,$$

where g_i^n represent operator components (Operators I–XI), and g_{12}^n encodes the Collapse dimension. Operator XII acts as a nonlinear projection:

$$O_{12}(G_n) = -G_n + \varepsilon_n,$$

with ε_n the residual seed vector carrying minimal recursive potential forward. The recursive map is

$$G_{n+1} = F(G_n) = \sum_{i=1}^{12} O_i(G_n).$$

Collapse enforces $g_{12}^{n+1} \to 0$ while maintaining $\varepsilon_n \neq 0$, preserving information continuity.

3 Collapse–Seed–Regrow Dynamics

The symbolic chain corresponds to:

$$\begin{gathered}(()) \Rightarrow () : O_{12}(G_n) = -G_n + \varepsilon_n, \\ () \Rightarrow (()) : G_{n+k} = F^k(\varepsilon_n).\end{gathered}$$

Collapse is the projection to the zero-point subspace; regrowth arises through amplification by the non-collapse operators $O_{1..11}$. The recursion closes when

$$G_{n+k} \approx JG_n,$$

where J is an orientation-inverting Klein involution, representing the non-orientable topology of the recursion manifold.

4 Round-Trip Fidelity Metric

The recurrence fidelity of the cycle is measured by:

$$\mathrm{RF}(n,k) = \frac{\langle G_{n+k}, JG_n\rangle_{\mathrm{UNNS}}}{\|G_{n+k}\|\|G_n\|},$$

where the UNNS inner product is

$$\langle G_n, G_m\rangle_{\mathrm{UNNS}} = \sum_{i=1}^{11} g_i^n g_i^m.$$

For an ideal recursive morphism, RF ≈ 1, indicating structural return up to Klein inversion.

5 Numerical Example

Let $d = 12$, with parameters:

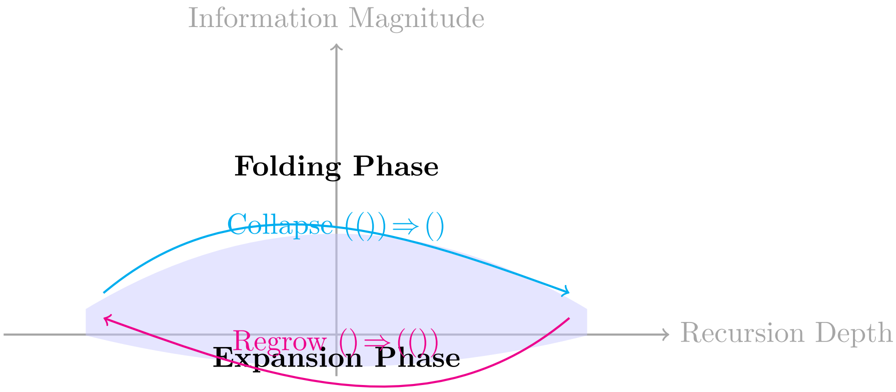
$$\alpha_i = 10^{-3}, \quad O_i(G) = W_i \tanh(B_i G), \quad J = \mathrm{diag}(-1, \ldots, -1, 1).$$

Simulating:

$$G_0 = (1, 0.5, 0.2, \ldots, 0.1), \quad \varepsilon_0 = \sum_{i=1}^{11} \alpha_i g_i^0 e_i,$$

and iterating $G_{n+1} = F(G_n)$ yields a cycle where $\|O_{12}(G_n)\|/\|G_n\| < 0.01$ and RF > 0.98. The recursion cone folds into the zero-point and re-expands—numerically verifying the symbolic morphism.

6 Diagram of Recursive Folding and Re-Expansion



7 Interpretation and Outlook

The UVP framework shows that even the simplest symbolic recursion can be modeled as a complete field transformation with conservation of recursive energy. Collapse corresponds to echo absorption; regrowth corresponds to self-seeded amplification. The $(()) \Rightarrow () \Rightarrow (())$ cycle thus represents the minimal self-sustaining loop in the UNNS substrate—an informational analogue of the Klein manifold's non-orientable closure.

Acknowledgments

This work is part of the UNNS foundational research into recursive field dynamics and substrate symmetry, as developed in the UNNS Vector Protocol.

References

[1] UNNS Research Initiative, *Unbounded Nested Number Sequences: Recursive Dynamics and Operator Collapse*, UNNS Technical Series, 2025.

[2] UNNS Research Initiative, *The UNNS Vector Protocol (UVP): Recursive Algebra for Operator Systems*, 2025.