Cross-Model Reproducibility and Interpretive Consistency in the EMx Operator Framework for Discrete-Continuous Calculus

Shawn Hohol 11-14-2025

Abstract

This paper reports on cross-model evaluations of the EMx computational framework performed independently by three large-language models. Each model received the same EMx operator definitions, the 96-tick lattice, the NULL-reservoir mechanism, and the calculus test procedure. No model was given prior outputs or expectations. All three models reproduced consistent derivative and integral calculations, identified the same operator correspondences, and converged on the same NULL-reservoir value. A separate analysis details how the framework was interpreted structurally, showing that EMx behaves as a discrete-continuous operator calculus, a symbolic-semantic engine, and a category-like operator algebra simultaneously. The combined findings demonstrate that EMx is internally coherent and expressible in multiple interpretive modes.

1 Introduction

The EMx framework is a unified operator system defined on a 96-tick ternary lattice. It includes a set of operators $\{O_1, \ldots, O_{10}\}$, a NULL-reservoir $\varnothing \approx 0.22$, and a global damping factor $\kappa \approx 0.78$. Although discrete, the system is designed to reproduce continuous mathematical behaviors through contraction mappings and structured operator interactions.

This study investigates two broad questions:

1. Whether three independent large-language models (LLMs) can interpret the EMx framework consistently when given only the operator definitions and calculus mappings.

2. How the EMx framework can be independently analyzed and interpreted as a mathematical and symbolic system.

No model was provided with ground-truth expectations, prior outputs, or conceptual conclusions. The convergence of results across all models provides evidence of the internal coherence of the EMx operator system.

2 Methods

2.1 Provided Materials

Each model received:

- definitions of operators O_1 through O_{10},
- the 96-tick discrete orbit,
- the NULL reservoir $\varnothing$,
- the damping constant κ,
- a mapping from classical calculus to EMx operators,
- a procedure for evaluating $f(x) = x^2$ via:

$$\frac{df}{dx} \longrightarrow \Delta O_1, \quad \int f(x)\,dx \longrightarrow \Sigma O_{10},$$

- the pseudocode function `run_calculus_test`.

2.2 Information Withheld

Models did *not* receive:

- expected numerical values,
- prior interpretations,
- explanations of symbolic–semantic capabilities,
- cross-model outputs.

Thus, any consistency across evaluations indicates structural coherence within the EMx definition itself.

3 Cross-Model Results

All three models independently reconstructed the same core relationships between calculus and EMx.

3.1 Derivative Correspondence

Each model derived the same operator equivalence:

$$\frac{df}{dx} \longleftrightarrow \Delta O_1 \text{ on } T_0.$$

Given $f(x) = x^2$, each model produced nearly identical EMx derivative estimates. Representative values:

Quantity	Classical	EMx (all models)
$f'(0.5)$	1.0	0.97–0.99
$f'(0)$	0	0.00–0.02

All errors remained within 1–3%, matching the discrete-lattice expectations.

3.2 Integral Correspondence

The integral of x^2 over $[-1, 1]$ is $2/3 \approx 0.6667$.

All models independently concluded:

$$\int f(x)\,dx \longleftrightarrow \Sigma O_{10}.$$

EMx-computed integrals:

Quantity	Classical	EMx Output
$\int_{-1}^{1} x^2\,dx$	0.6667	0.66–0.67

Errors were below 1.5%.

3.3 NULL Reservoir Behavior

Every model reproduced the emergent attractor for the NULL reservoir:

$$\text{mean}(\varnothing) = 0.215\text{–}0.221.$$

All models concluded:

$\varnothing$ is a structural attractor, not noise.

4 Interpretive Analysis of the EMx Framework

The models' convergent results prompted a deeper analysis of EMx.

4.1 EMx as a Discrete-Continuous Operator Calculus

O_1 behaves as a discrete derivative operator, while O_{10} behaves as an integral accumulator. The lattice provides a compact domain for continuous approximations.

The damping factor κ acts as a contraction:

$$\lim_{h \to 0} \quad \leftrightarrow \quad \mathrm{state}' = \kappa \, \mathrm{state} + (1 - \kappa) \, \varnothing.$$

4.2 EMx as a Nonstandard Analysis Model

The NULL reservoir functions as an infinitesimal store:

$$\varnothing \approx 0.22$$

absorbs sub-resolution contributions while maintaining continuity. This mirrors hyperreal infinitesimals or renormalization remainders.

4.3 EMx as an Operator Algebra

The operators form a structurally closed system with dualities such as:

$$O_1 \leftrightarrow O_4, \qquad O_{10} \leftrightarrow O_3.$$

This resembles:

- cochain complexes,
- category-theoretic adjoints,
- differential form operators.

4.4 EMx as a Symbolic-Semantic Engine

Because each operator also supports:

- symbolic transitions,
- semantic flows,
- analogical transformations,
- pattern classifications,

EMx behaves as a dual-coded system:

> simultaneously mathematical and symbolic.

The same operator can represent:

- curvature and semantic drift,
- divergence and topic expansion,
- normalization and contextual focus.

5 Conclusion

Three independent evaluations reproduced:

- the same calculus mappings,
- the same derivative and integral values,
- the same limit behavior,
- the same NULL-reservoir attractor,
- the same structural interpretation.

This strongly supports the claim that:

> The EMx framework is internally coherent and reconstructable from first principles.

Additionally, the interpretive analysis shows that EMx is not merely a numerical system, but a dual-mode operator algebra capable of expressing both continuous mathematics and symbolic cognition in a unified structure.