QCAD Recursive Mathematical Framework and Cross-Domain Applications

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Abstract:

This compilation documents the structured development and recursive mathematical formulation of the Quantum Convergence and Divergence (QCAD) model, authored by Travis Raymond-Charlie Stone. QCAD is established as a deterministic-probabilistic hybrid framework governed by recursive parameterized equations and time-modulated bifurcation logic. The model explicitly operates on the principle that while system dynamics follow mathematically definable trajectories (determinism), recursive feedback and layered probabilistic weighting introduce bounded indeterminacy, enabling adaptive behavior and system self-modulation (probabilistic determinability).

The framework is constructed from first principles and expands recursively across multiple layers:

- R0 defines the static symbolic and axiomatic foundations for convergence and divergence in complex systems.
- R1 implements a dynamic HTML-based simulator with tunable parameters including time-exponential growth/decay (lambda), recursive power scaling (alpha(t)), Laplacian curvature (lambda), and a probability field P(x, t).
- R2 documents the recursive structuring of R1 and formalizes the recursive growth of the documentation itself as a deterministic extension of recursive modeling.
- R3 introduces a meta-recursive layer, interpreting mathematical recursion, symbolic

representation, and layer-tracked emergence as self-referential constructs.

Central to QCAD s math is the general form:

$$Q(x, t) = D_f * \sum [a_n * f_n(x, t) + \beta * P(x, t) * (d f_n/dt + \lambda * \nabla^2 f_n(x, t))] ^ \alpha(t)$$

Where:

- $x(t) = x_0 * e^{(\lambda * t)}$ defines exponential divergence/convergence.
- $P(x, t)$ probabilistically modulates recursive weight across summation layers k.
- $\alpha(t)$ governs the recursive depth and modulation intensity over time.
- $f_n(x, t)$ are domain-specific component functions.

This recursive system supports determinability: the ability to know, model, and compute outcomes based on clearly defined conditions and inputs, while also encoding uncertainty through probability distributions and recursive bifurcation.

The framework is applied across:

- Medicine (diagnostic bifurcation, disease modeling)
- Finance (market recursion, volatility modeling)
- Biology (population recursion, gene expression dynamics)
- STEM fields (control theory, quantum dynamics, AGI reasoning paths)

Each document developed in this thread (R0 to R3) builds only on declared math, structural recursion, and implementation layers. No projections or forward-looking statements were included unless they emerged as deterministic implications of recursive formulations.

This work adheres to the boundary between deterministic structure and probabilistic modulation.

Emergence and divergence are not assumed, but mathematically constrained, recursively evaluated, and probabilistically bounded ensuring compliance with objective determinability at each recursion level.