Growth Systems

A Coherence-Driven Theory of Evolving Equilibrium

Abstract

This work develops a nonlinear oscillatory field theory in which equilibrium is not fixed but dynamically constructed. Structure emerges through coherence, while entropy regulates growth.

1. Field Dynamics

The system evolves according to a second-order equation combining inertia, damping, transport, equilibrium attraction, and growth. $d^2\Phi/dt^2 + R(\Phi)d\Phi/dt = D\nabla^2\Phi - k(\Phi-Z) + G(\Phi)$ This ensures oscillatory motion rather than convergence.

2. Coherence

$C = 1 / (1 + Var(\partial_t \Phi))$ Coherence measures alignment of motion. As variance decreases, coherence increases toward unity.

3. Entropy

$E = |v|^2 + |\nabla\Phi|^2$ Entropy combines kinetic and spatial disorder, limiting growth.

4. Growth

$G = \gamma C/(E + \varepsilon)(1 - |\Phi - Z|/L)$ Growth occurs when coherence exceeds entropy and saturates near equilibrium.

5. Multi-Zero Dynamics

$dZ_i/dt = \Sigma \kappa(Z_j - Z_i)$ Equilibria interact and align, forming a distributed network.

6. Energy

$E = \int(|\partial t\Phi|^2 + |\Phi\text{-}Z|^2)\, dx$ Energy balances motion and displacement from equilibrium.

7. Energy Evolution

$dE/dt = \int(G - R|\partial t\Phi|^2)\, dx$ Energy increases when growth exceeds dissipation.

8. Phase Transition

$C > Cc$ Above threshold coherence, structure persists; below it, decay dominates.

9. Interpretation

The system can be viewed as a wave, a fluid, or a network of interacting equilibria.

10. Conclusion

Growth Systems describe a class of nonlinear oscillatory systems where equilibrium is constructed dynamically and structure emerges from coherence.