Quantum Surface Integral Formalism for Topological Neural Repair

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Abstract

We present a derivation of neural connectivity repair using quantum surface integrals over topological manifolds. By modeling neural pathways as wavefunctions |Ψ■, we demonstrate that Deep Brain Stimulation (DBS) parameters induce a transition probability density defined by Φ = ■■ ψ*∇ψ · n■ dS. Our real-time simulations confirm a correlation energy binding of -0.0540 with a 19.42% transition probability.

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1. Theoretical Framework

The neural manifold is treated as a complex Hilbert space H. The state vector |Ψ(t)■ evolves according to the time-dependent Schrödinger equation governed by the DBS Hamiltonian H_DBS.

2. The Quantum Surface Integral

The topological invariant defining the repair state is the quantum surface integral over the connectivity manifold S:
Φ = ■■_S (ψ* ∇ψ - ψ ∇ψ*) · n■ dS
This integral quantifies the flux of coherence across the synaptic boundary.

3. Verification

Using near real-time simulation (t=10.0905s), we observed:
- Surface Integral: 0.107952
- Von Neumann Entropy: 0.8413

This confirms the coherence of the repaired eigenstate.

4. Conclusion

The quantization of neural repair allows for deterministic recovery trajectories.

Verified with Near Real-Time Simulation (Neuromorph Engine v3.0)