

Navigating Technological Transitions

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Network dynamics offer humanity a **polynomial-time computable framework** for understanding and steering complex systems through technological bottlenecks.

Key Insights:

- **Computational Tractability:** The model operates in $O(Tn^2)$ time, making large-scale network simulation feasible even for planetary-scale systems
- **Emergent Optimization:** Systems naturally evolve toward states balancing realized value ($O(S_t)$) and latent potential ($L(S_t)$) without centralized control
- **Transition Management:** The neutral state N provides crucial flexibility during periods of rapid change
- **Efficiency Principle:** The metric $\gamma(S_t)$ offers a quantifiable measure of system health during transitions

For Technological Survival:

- This framework enables **predictive governance** of AI networks, supply chains, and social systems
- The polynomial-time nature means we can **simulate crises before they occur**
- The autonomy emergence law suggests how distributed systems can **self-stabilize** under stress
- Unlike NP-hard optimization problems, this model remains **computationally feasible** even as systems scale

Crucial Limitation:

While the dynamics are polynomial-time computable, finding the optimal state S^* is likely NP-hard. This reflects a fundamental truth: we can efficiently navigate toward better states, but perfect optimization remains computationally intractable—a humbling reminder that survival requires adaptation, not perfection.

The polynomial-time nature of these dynamics suggests that humanity’s survival through technological bottlenecks is computationally feasible—if we apply these principles wisely.

This work provides not just a theoretical framework, but a **practical computational tool** for navigating the complex network dynamics that will determine our collective future. The mathematics suggests that survival is possible; the implementation will determine whether it is achieved.