

FRE — One-Page Grant Summary

Project: Flexion Risk Engine (FRE)

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Repository: <https://github.com/MaryanBog/FRE>

Field: Structural Risk Modeling, Financial Stability, CeFi/DeFi Infrastructure

Tech Level: Research Prototype + Full Specification + Simulator V2.0

1. Problem

Modern financial systems fail due to discontinuous, reactive, price-driven risk mechanics.

This produces:

- liquidation cascades
- margin cliffs
- VaR volatility blowups
- reflexive feedback loops
- systemic contagion
- catastrophic market breakdowns

These failures occur even in perfectly solvent systems because

their risk engines are structurally unstable.

Conventional models:

- rely on thresholds, heuristics, and buffers
- respond to volatility instead of controlling structure
- amplify positive feedback under stress

A new approach is needed: continuous, bounded, mathematically stable risk dynamics.

2. Solution — Flexion Risk Engine (FRE)

FRE is the **first structural risk engine** based on Flexion Dynamics V2.0.

It defines risk as a structural state:

$[X = (\Delta, \Phi, M, \kappa)]$

with continuous evolution:

$[\frac{dX}{dt} = F_{\text{flow}}(X)]$

Where:

- Δ — structural deviation
- Φ — structural energy
- M — irreversible memory

- κ — contractivity (viability metric)

Key guarantee:

$\kappa \geq 0$ ensures the system remains viable and cannot collapse.

FRE provides:

- smooth continuous risk evolution
- suppression of cascades and cliffs
- stability under extreme volatility
- independence from price and market regime
- formal mathematical auditability

3. Evidence & Readiness

Already implemented and available:

✓ Full Mathematical Specification (LaTeX + Markdown)

✓ FRE Simulator V2.0

- deterministic evolution
- stress scenarios
- deviation vector Δ_s
- stability zone classification
- reproducible test suite

✓ Documentation Suite

- integration guides
- JSON specification
- CeFi/DeFi adapters
- validation protocols

✓ Minimal FRE conceptual example

✓ Apache 2.0 License

✓ Release v1.2 (documentation modernization)

The project is fully positioned for the next implementation phase.

4. Grant Impact

Funding accelerates:

1. FRE V2.0 Engine Implementation

- full Δ - Φ - M - κ structural flow

- admissibility constraints
- contractivity enforcement
- equilibrium analysis

2. Python & TypeScript SDKs

- ready for exchanges, banks, and DeFi platforms

3. Advanced Simulator & Visualizations

- collapse geometry
- viability mapping
- high-resolution structural stress tests

4. Integration Pilots

- margin systems
- CDP/stablecoin architectures
- risk engines in CeFi/DeFi
- real-time stability modules

Outcome: a provably stable, collapse-resistant risk engine for global financial infrastructure.

5. Why This Matters

FRE can prevent entire categories of failures that today are considered unavoidable:

- cascading liquidations
- solvency-independent collapses
- volatility-induced feedback loops
- systemic contagion

Impact areas:

- financial stability
- digital asset markets
- HFT risk control
- clearing & collateral engines
- real-time automated risk systems

This is a new foundational model for structural safety in finance.

6. Funding Request

Amount: \$50,000–\$150,000

Use of Funds:

- FRE V2.0 engine implementation
- SDK development

- simulator expansion
- integration pilots
- open-science publication
- security & validation research