# Semantic Derivation Compression (SDC)

## 1. Introduction

Semantic Derivation Compression (SDC) is a novel approach to context management in language models. Rather than treating tokens as a linear sequence of discrete units, SDC assumes that each sentence encodes a functional semantic vector, which can be modeled and compressed through differential calculus. This allows semantic memory to be reconstructed on demand from a compressed, continuous representation.

## 2. Core Idea

- Treat each semantic unit (e.g., sentence or clause) as a differentiable function.

- Extract the first, second, or higher-order derivatives of the semantic trend.

- Store compressed context as derivative coefficients and a semantic baseline.

- Use integration to recover full semantic states when needed.

## 3. Compression Workflow

1. Parse sentence and map to semantic vector space.

2. Apply symbolic or numerical differentiation to obtain semantic 'slopes' and 'curvature'.

3. Store only the constant term, first derivative, and optional higher-order derivatives.

4. During recall, perform symbolic or parametric integration to recover detailed meaning.

## 4. Advantages

- Drastically reduces the number of tokens or vectors needed to represent long context.

- Emulates human-like understanding by tracking the trend of meaning, not the surface structure.

- Integrates seamlessly with attention-based systems as a context caching module.

- Potential to be paired with memory routing, hierarchical abstraction, or gradient-based memory trees.

## 5. Use Case

Example: A document about AI evolves from "Neural Nets" to "Transformers" to "Multi-modal AGI".

Traditional LLMs need to retain every token; SDC compresses the trend via derivative representation and reconstructs only what is needed for the current query or generation.

## 6. Conclusion

SDC offers a biologically inspired, mathematically grounded alternative to linear context memory. By leveraging calculus, it reduces the burden on transformer memory and enables scalable AGI pipelines.