Sample SR&ED Claim Package

Aegis Tech · T661 Part 2 technical narratives · generated entirely on local hardware

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Line 242 — Scientific or technological uncertainties

229 words · evidence: `7fc35def50` `6e8c31cfb6` `9f730c73b9`

At the outset, existing knowledge bases offered standard ODE integration methods and generic parsing algorithms; however, these approaches failed to address specific constraints regarding mixed time scales in stiff systems and strict streaming latency requirements without sacrificing accuracy or performance. Specific uncertainties blocked this objective. First, it was unknown whether multi-rate coupling schemes for Ordinary Differential Equation (ODE) solvers could maintain strict energy conservation (Hamiltonian properties) under mixed time scales. Empirical validation at SHA 7fc35def revealed that while mixed time scales theoretically improved performance, they introduced an unquantified failure mode characterized by long-term energy drift, rendering the solutions physically invalid for the target stiff systems. Second, the relationship between step-size adaptation strategies and this resulting energy drift remained undefined; standard adaptive methods could not predict or mitigate the drift in complex physical environments. Third, it was uncertain if Richardson extrapolation could deliver stable order-of-accuracy gains in stiff ODE systems without prohibitive computational overhead. Testing at SHA 6e8c31cf showed that higher-order error control failed to converge efficiently compared to residual-based controls under specific stiffness conditions. Finally, regarding natural language processing, the viability of Earley chart parsing versus recursive descent for handling deeply nested grammatical structures within strict streaming latency constraints was unknown. Comparative analysis at SHA 9f730c73 demonstrated that while Earley parsing offered correctness on complex inputs, it incurred a ninefold slowdown relative to recursive descent, violating real-time processing requirements.

Line 244 — Work performed

646 words · evidence: 7fc35def50 6e8c31cfb6 9f730c73b9 1244a2a36c 6b1f87d8dc 32db18ead5

Line 246 — Advancements achieved

291 words · evidence: 7fc35def50 6e8c31cfb6 9f730c73b9 1244a2a36c

The project resolved technical uncertainties regarding numerical stability in stiff Ordinary Differential Equation (ODE) systems and real-time parsing efficiency.

First, the feasibility of multi-rate coupling schemes for ODE solvers under mixed time scales was determined to be unviable while maintaining strict energy conservation (Hamiltonian properties). Empirical validation confirmed that this approach introduced an unknown failure mode characterized by long-term energy drift, preventing solutions from meeting physical constraints. This investigation clarified the relationship between step-size adaptation strategies and energy drift in complex systems, leading to the abandonment of the mixed-time-scale hypothesis in September 2025.

Second, the conditions under which higher-order error control methods fail were identified. Testing Richardson extrapolation against stiff ODE systems revealed that achieving stable order-of-accuracy gains incurs prohibitive computational overhead compared to residual-based controls. The investigation concluded that higher-order methods do not converge efficiently within wall-clock time constraints for these specific system types, necessitating a reversion to lower-order error control mechanisms in September 2025.

Third, algorithmic selection for handling deeply nested grammatical structures was resolved by evaluating Earley chart parsing versus recursive descent under strict streaming latency constraints. Performance metrics demonstrated a 9x slowdown when utilizing the Earley approach compared to recursive descent, confirming that context-free grammar strategies optimized for deep nesting cannot meet real-time requirements without sacrificing correctness on complex inputs in September 2025.

Finally, memory scalability of packrat memoization techniques was assessed. Testing confirmed that standard implementation leads to critical failure modes described as memory blowup when applied to deeply nested parse trees in streaming contexts. This uncertainty was resolved by iteratively developing bounded windows, establishing that exponential space complexity inherent in certain parsing algorithms can be mitigated only through specific windowing strategies under defined input distributions in September 2025.

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