Feedback on "Using the θ-method to Solve ODEs"

Overall Summary

This is a well-structured technical report on the θ-method for solving ODEs. It covers derivations, error analysis, and numerical examples in a logical order. However, there are several small issues with grammar, notation, and clarity that could be improved for a polished, professional finish.

1. Writing & Grammar

- Misuse of "it's" vs. "its" (e.g., "deriving it's truncation error" → "deriving its truncation error").
- Typographical errors such as "achieve" → "achieved", "implcit" → "implicit", "Rhapson" → "Raphson", "spacial" → "spatial", and "oder" → "order".
- Minor phrasing issues — tighten expressions like "we use this to derive an expression for the local error" to "we then derive the local error expression."
- Be consistent with article usage: use "the θ-method" consistently.

2. Mathematical Presentation

- Equation formatting: In the θ-method definition, ensure 'Un + 1' is corrected to 'Un+1'.
- Fix missing equation references such as 'Equation (??)' by checking LaTeX labels.
- Use Δt consistently instead of dt to match notation across sections.
- In the Newton–Raphson code, correct formatting (indentation and variable names like 'fprime').

3. Figures and Results

- Add brief parameter descriptions (step size, N value) to figure captions.
- Clarify that the 'exact solution' is an approximation from the fine-grid Crank–Nicolson method (N=10000).
- Ensure legends and axis labels are readable in grayscale.

4. Technical Accuracy

Derivations of truncation and global error are correct and well-reasoned. Consider explicitly stating that the global error has the same order as the truncation error to make this clearer.

5. References

Current references (Morton & Mayers, Süli & Mayers) are solid. You could add another, such as Butcher's Numerical Methods for ODEs, for completeness.

6. Clarity & Flow Suggestions

- The section on spatial dependence (end of Section 1) could be shortened or moved to a 'Future Work' comment.
- In Section 3, briefly explain why Newton–Raphson is necessary (nonlinear implicit step).
- Expand the conclusion with comments on stability or implicit vs. explicit trade-offs.

7. Summary of Key Fixes

Type	Issue	Example	Suggested Fix
Grammar	it's / its	"deriving it's truncation error"	"deriving its truncation error"
Typo	"implcit"	"implcit equation"	"implicit equation"
Math	Un + 1	"Un + 1"	"Un+1"
Referencing	Equation (??)	Missing label	Fix LaTeX \label and \ref
Style	Inconsistent Δt vs dt	Throughout	Use Δt consistently
Figures	Weak captions	"Figure 2: 'Exact' solution…"	Add description of parameters