

# Efficient time integration of nonlinear partial differential equations by means of Rosenbrock methods

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## SUMMARY

We avoid as as much as possible the order reduction of Rosenbrock methods when they are applied to nonlinear partial differential equations by means of a similar technique to the one used previously by us for the linear case [1]. For this we use a suitable choice of boundary values for the internal stages. The main difference from the linear case comes from the difficulty to calculate those boundary values exactly in terms of data. In any case, the implementation is cheap and simple since, at each stage, just some additional terms concerning those boundary values and not the whole grid must be added to what would be the standard method of lines.

**Keywords:** Nonlinear partial differential equations, Rosenbrock method, order reduction

**AMS Classification:** 65M12, 65M20

## References

- [1] I. ALONSO-MALLO & B. CANO. Spectral/Rosenbrock discretizations without order reduction for linear parabolic problems. *Appl. Num. Math.* **47**, 247–268, 2002.
- [2] I. ALONSO-MALLO & B. CANO. Efficient time integration of nonlinear partial differential equations by means of Rosenbrock methods. *Mathematics* **1,0**, <https://doi.org/10.3390/math1010000>, 2021.

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