

## Accepted Manuscript

An improved local error estimator for symmetric time-stepping schemes

Winfried Auzinger, Othmar Koch

PII: S0893-9659(18)30065-X  
DOI: <https://doi.org/10.1016/j.aml.2018.03.001>  
Reference: AML 5448

To appear in: *Applied Mathematics Letters*

Received date: 30 December 2017  
Revised date: 1 March 2018  
Accepted date: 2 March 2018

Please cite this article as: W. Auzinger, O. Koch, An improved local error estimator for symmetric time-stepping schemes, *Appl. Math. Lett.* (2018), <https://doi.org/10.1016/j.aml.2018.03.001>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



# An improved local error estimator for symmetric time-stepping schemes

Winfried Auzinger

*Technische Universität Wien, Institut für Analysis und Scientific Computing, Wiedner Hauptstrasse 8-10/E101, A-1040 Wien, Austria*

Othmar Koch\*

*Universität Wien, Institut für Mathematik, Oskar-Morgenstern-Platz 1, A-1090 Wien, Austria*

---

## Abstract

We propose a symmetrized version of the defect to be used in the estimation of the local time-stepping error of symmetric one-step methods for the time propagation of linear autonomous evolution equations. Using the anti-commutator of the numerical flow and the right-hand side operator in the definition of the defect of the numerical approximation, a local error estimator is obtained which has higher accuracy asymptotically than an established version using the common defect. This theoretical result is illustrated for a splitting method applied to a linear Schrödinger equation.

*Keywords:* Numerical time integration, one-step methods, symmetric schemes, local error estimation

*2010 MSC:* 65L05, 65L50

---

## 1. Introduction

Consider the evolution equation

$$u'(t) = H u(t), \quad u(0) = u_0, \quad (1)$$

defined on a Banach space  $\mathcal{X}$ , with a generally unbounded time-independent operator  $H: \mathcal{D}(H) \subset \mathcal{X} \rightarrow \mathcal{X}$  which generates a semigroup. We assume that the problem is well-defined with a sufficiently regular solution  $u$ , and denote the

---

\*Corresponding author

*Email addresses:* [w.auzinger@tuwien.ac.at](mailto:w.auzinger@tuwien.ac.at) (Winfried Auzinger),  
[othmar@othmar-koch.org](mailto:othmar@othmar-koch.org) (Othmar Koch)

*URL:* <http://www.asc.tuwien.ac.at/~winfried/> (Winfried Auzinger),  
[www.othmar-koch.org](http://www.othmar-koch.org) (Othmar Koch)

Download English Version:

<https://daneshyari.com/en/article/8053731>

Download Persian Version:

<https://daneshyari.com/article/8053731>

[Daneshyari.com](https://daneshyari.com)