

Accepted Manuscript

On the relation between conservation and dual consistency for summation-by-parts schemes

Jan Nordström, Fatemeh Ghasemi

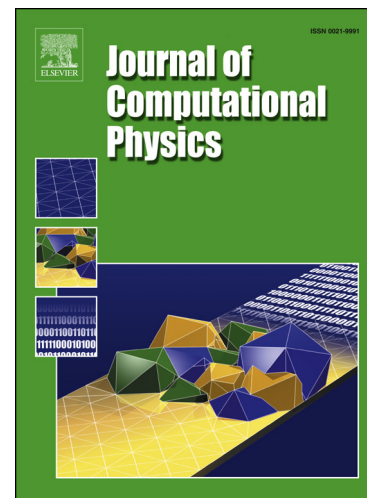
PII: S0021-9991(17)30360-1
DOI: <http://dx.doi.org/10.1016/j.jcp.2017.04.072>
Reference: YJCPH 7338

To appear in: *Journal of Computational Physics*

Received date: 13 April 2017
Accepted date: 27 April 2017

Please cite this article in press as: J. Nordström, F. Ghasemi, On the relation between conservation and dual consistency for summation-by-parts schemes, *J. Comput. Phys.* (2017), <http://dx.doi.org/10.1016/j.jcp.2017.04.072>

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.



On the relation between conservation and dual consistency for summation-by-parts schemes

Jan Nordström & Fatemeh Ghasemi

*Department of Mathematics, Computational Mathematics, Linköping University,
SE-581 83 Linköping, Sweden*

jan.nordstrom@liu.se, fatemeh.ghasemi@liu.se

1. Introduction

We consider initial boundary value problems discretized by summation-by-parts (SBP) operators together with the simultaneous approximation term (SAT) technique. In [1, 2, 3, 4], it was shown that dual consistent discretizations on SBP-SAT form, leads to superconvergent linear functionals. For multi-block/element SBP-SAT based schemes [5, 6, 7, 8, 9], conservation is one of the most important issues. In this note, we show that dual consistency and conservation are equivalent concepts for linear conservation laws.

2. The continuous problem

Consider the two coupled linear conservation laws

$$\begin{aligned} u_t + f_L(u)_x &= 0, & -1 \leq x \leq 0, & t > 0, \\ v_t + f_R(v)_x &= 0, & 0 \leq x \leq 1, & t > 0, \\ f_L(u(0, t)) &= f_R(v(0, t)), & x = 0, & t > 0, \end{aligned} \quad (1)$$

augmented with initial conditions. The m component long solution vectors u and v are smooth and continuous, also across the interface. The subscripts L, R refer to the left and right spatial intervals, respectively. For clarity and ease of presentation, we ignore the boundary conditions at $x = \pm 1$.

The coupled problem (1) can be written more compactly as

$$\begin{aligned} w_t + F(w)_x &= 0, & -1 \leq x \leq 1, & t > 0, \\ f_L(u(0, t)) &= f_R(v(0, t)), & x = 0, & t > 0, \end{aligned} \quad (2)$$

where the flux is given by

$$F(w) = \begin{cases} f_L(u), & -1 \leq x \leq 0 \\ f_R(v), & 0 \leq x \leq 1, \end{cases} \quad \text{and} \quad w = \begin{cases} u, & -1 \leq x \leq 0 \\ v, & 0 \leq x \leq 1. \end{cases}$$

For future reference we define the inner product as $(g, h)_a^b = \int_a^b g^T h \, dx$.

Download English Version:

<https://daneshyari.com/en/article/4967462>

Download Persian Version:

<https://daneshyari.com/article/4967462>

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