Bram’s Odyssey

Barry Koren

San Diego, June 22-23, 2013

Minimax problem

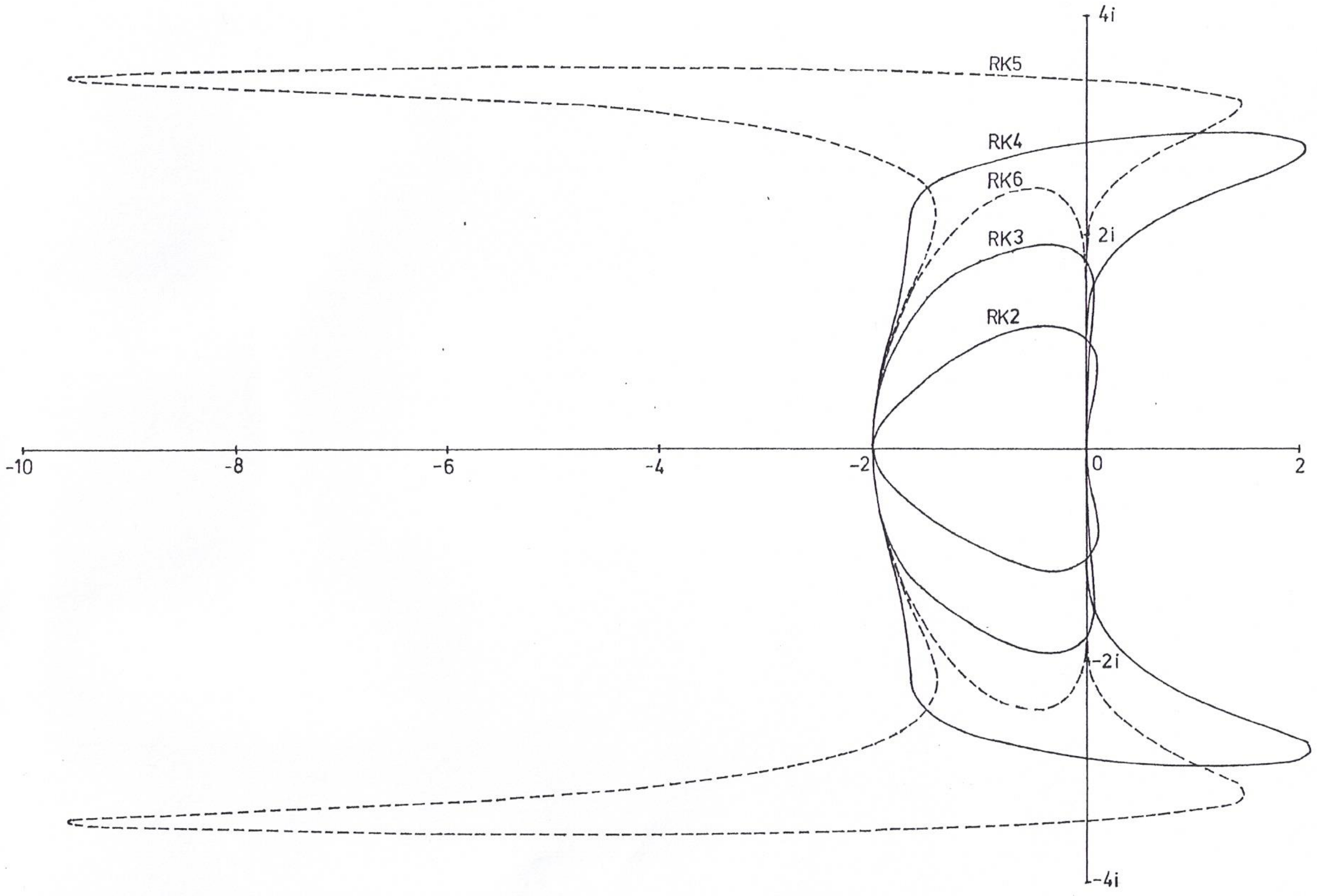


fig.2.2: Neutral stability curves Runge-Kutta schemes

Minimax problem

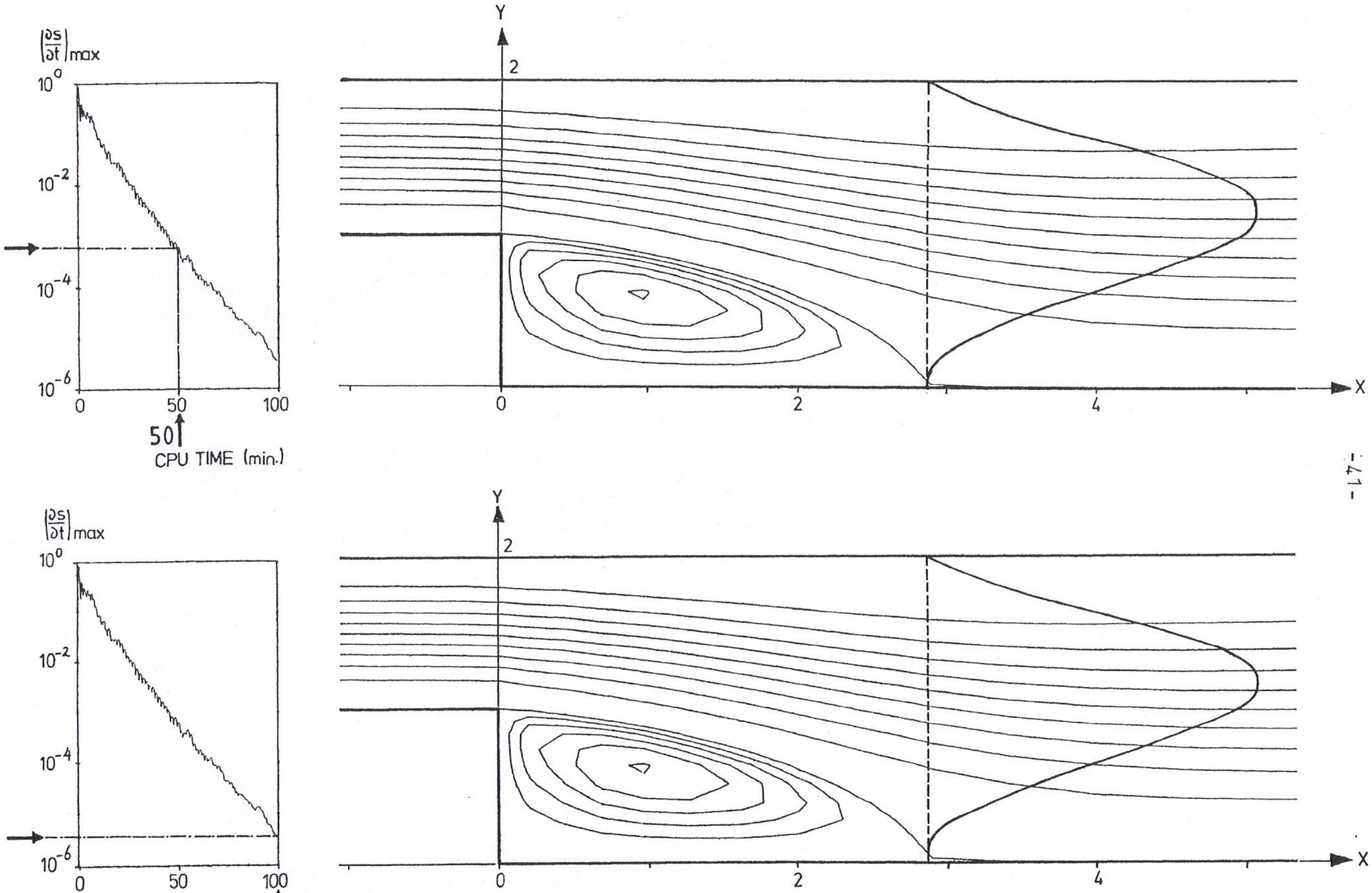
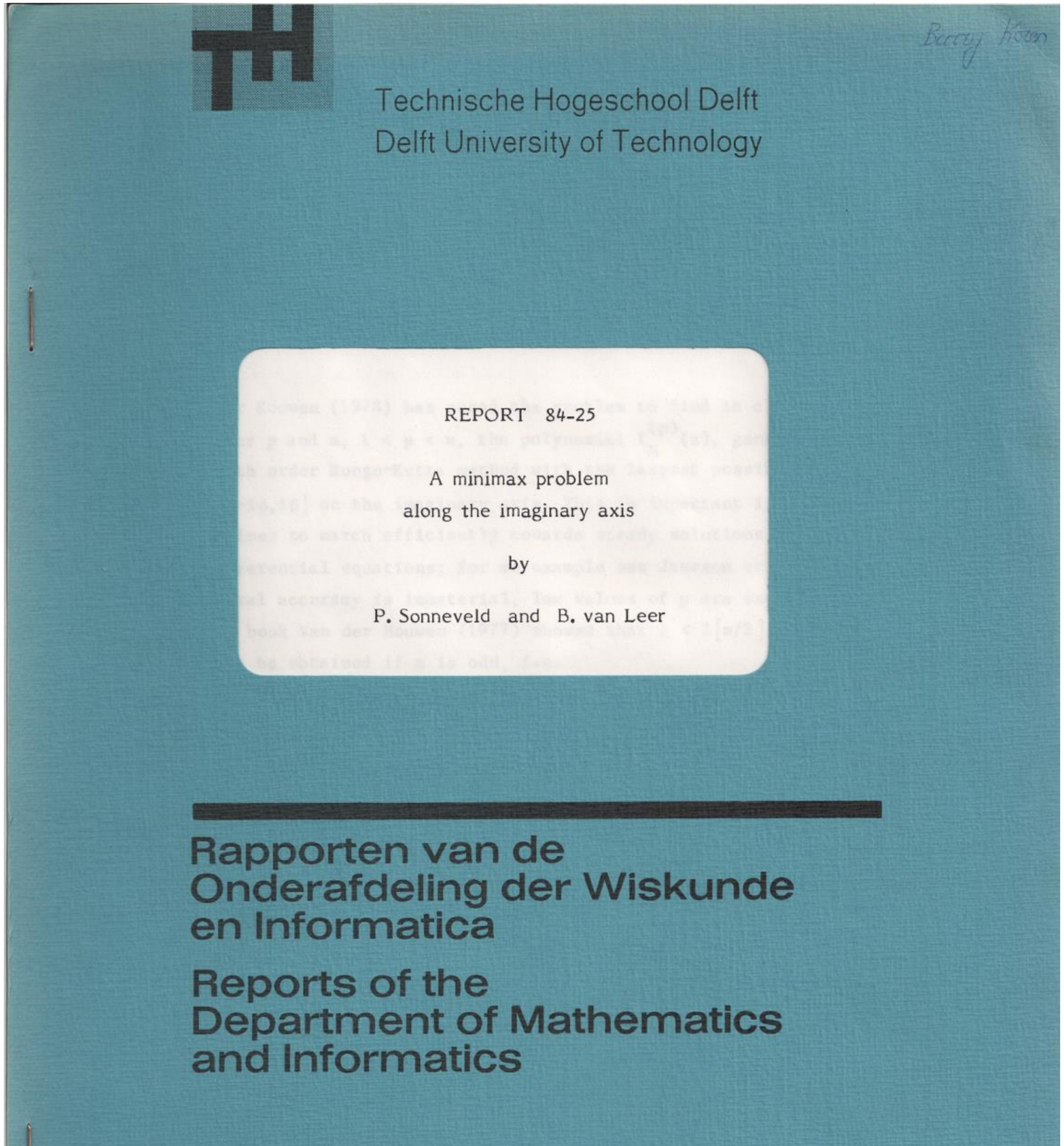


fig.3.4d: Streamline distribution after 50 and 100 minutes CPU TIME;
channel with small inlet, Re=50

Minimax problem


Technische Hogeschool Delft
Delft University of Technology

REPORT 84-25

A minimax problem
along the imaginary axis

by

P. Sonneveld and B. van Leer

Rapporten van de
Onderafdeling der Wiskunde
en Informatica

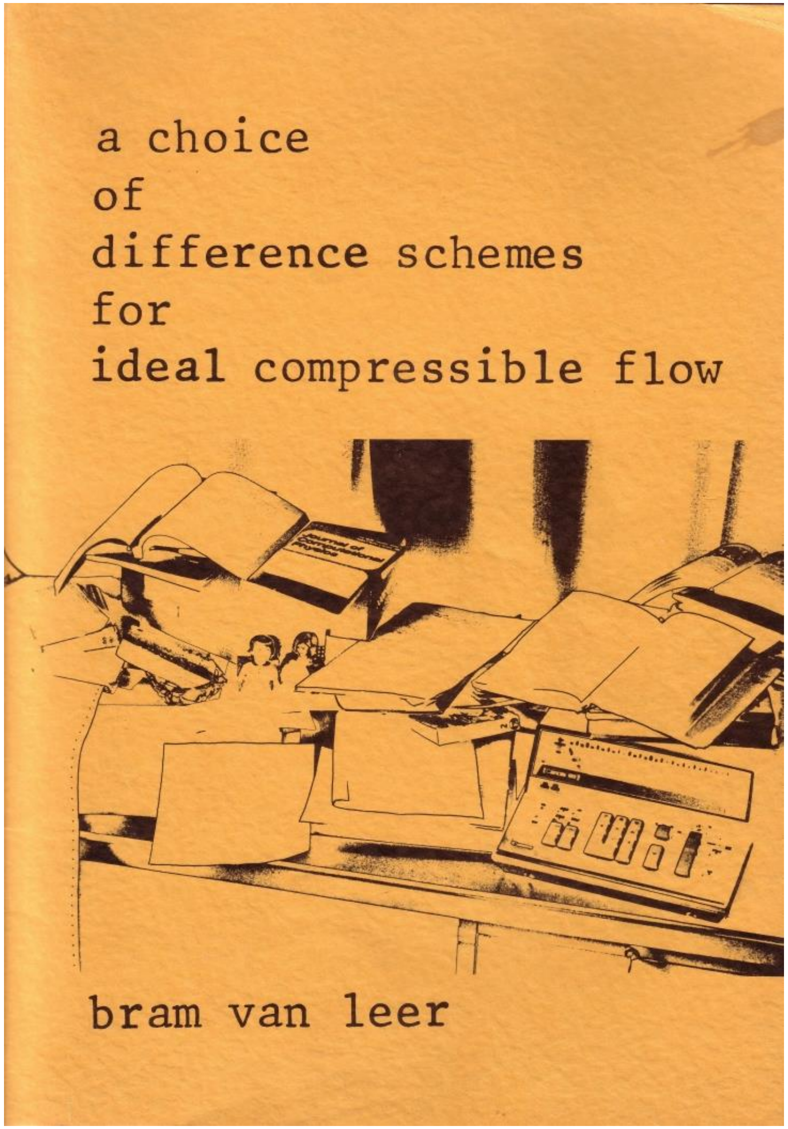
Reports of the
Department of Mathematics
and Informatics

Start Odyssey

Van de Hulst & Oort

Bram & Lia, 1966

PhD-thesis, 1970



Towards V, 1979

Barry Koren

JOURNAL OF COMPUTATIONAL PHYSICS **135,** 229–248 (1997)
ARTICLE NO. CP975704

Towards the Ultimate Conservative Difference Scheme

V. A Second-Order Sequel to Godunov's Method

Bram van Leer

University Observatory, Leiden, The Netherlands

Received October 18, 1977; revised October 17, 1978

A method of second-order accuracy is described for integrating the equations of ideal compressible flow. The method is based on the integral conservation laws and is dissipative, so that it can be used across shocks. The heart of the method is a one-dimensional Lagrangean scheme that may be regarded as a second-order sequel to Godunov's method. The second-order accuracy is achieved by taking the distributions of the state quantities inside a gas slab to be linear, rather than uniform as in Godunov's method. The Lagrangean results are remapped with least-squares accuracy onto the desired Euler grid in a separate step. Several monotonicity algorithms are applied to ensure positivity, monotonicity, and nonlinear stability. Higher dimensions are covered through time splitting. Numerical results for one-dimensional and two-dimensional flows are presented, demonstrating the efficiency of the method. The paper concludes with a summary of the results of the whole series "Towards the Ultimate Conservative Difference Scheme."

1. INTRODUCTION

This paper describes a method of second-order accuracy

tions, with due care taken to account for the discontinuities in the interaction flow. The convective difference scheme, hidden in the Lagrangean scheme, for integrating the characteristic equations is a so-called up-stream-centered (upwind) scheme and has been discussed as "scheme II" in the previous paper [2] of this series. Remapping the Lagrangean results onto an Euler grid is done according to the upstream-centered "scheme III" from the same paper. A substantial improvement will still result if, in the Lagrangean step, scheme II is replaced by the more accurate scheme III.

An accessory technique for preserving monotonicity during convection, also discussed in [2], is easily incorporated in the method. It is applied in its crudest form [2, Eq. (66)] at the beginning of the Lagrangean step; a more sophisticated form [2, Eq. (74)] is applied in the remap step. Further refinement of the technique has been projected.

Numerical experiments indicate that for solving two-dimensional flow problems, even on a coarse grid, the present second-order method is at least an order of magni-

Van Leer FVS, 1982

FLUX-VECTOR SPLITTING FOR THE EULER EQUATIONS

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Introduction

When approximating a hyperbolic system of conservation laws $w_t + \{f(w)\}_x = 0$ with so-called upwind differences, we must, in the first place, establish which way the wind blows. More precisely, we must determine in which direction each of a variety of signals moves through the computational grid. For this purpose, a physical model of the interaction between computational cells is needed; at present two such models are in use.

In one model, neighboring cells interact through discrete, finite-amplitude waves. The nature, propagation speed and amplitude of these waves are found by solving, exactly or approximately, Riemann's initial-value problem for the discontinuity at the cell interface. We may call this the Riemann approach (Fig. 1a). The numerical technique of distinguishing between the influence of the forward- and the backward-moving waves is called flux-difference splitting; examples are the methods of Roe [1] and of Osher [2].

In the other model, the interaction of neighboring cells is accomplished through mixing of pseudo-particles that move in and out of each cell according to a given velocity distribution. We may call this the Boltzmann approach (Fig. 1b). The numerical technique of distinguishing between the influence of the forward- and the backward-moving particles is called flux-vector splitting or simply flux-splitting; an example is the "beam scheme" of Prendergast [3], rediscovered by Steger and Warming [4].

Both kinds of splitting are discussed by Harten, Lax and Van Leer [5].

The present paper is restricted to flux-vector splitting for the Euler equations of compressible flow, with the ideal-gas law used as equation of state.

Van Leer FVS, 1990

Barry Koren

Flux Vector Splitting for the 1990's

Bram van Leer

The University of Michigan
Department of Aerospace Engineering
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February 1990

College of Engineering

DEPARTMENT OF AEROSPACE ENGINEERING

The University of Michigan
Ann Arbor, Michigan 48109-2140

ICASE, 1984

ICASE Report

Barry Koren

I C A S E

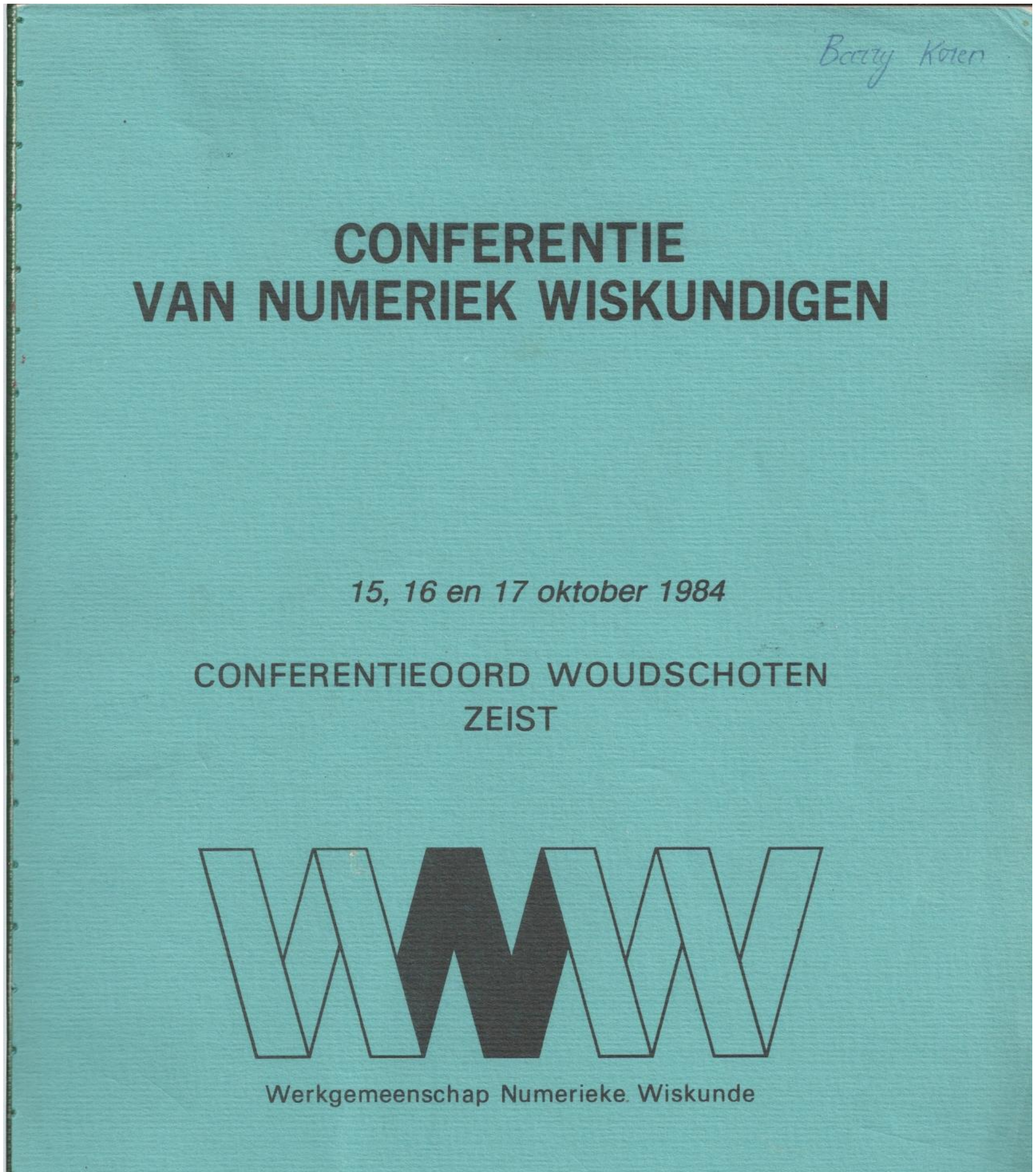
Special Internal Report

Pink Grundlehrer Series #2

'A ONE-SIDED VIEW'

Note: Reports in the ICASE Grundlehrer Series have no intrinsic value, scientific or otherwise.

Woudschoten, 1984



Woudschoten, 1984

UITGENODIGDE SPREKERS

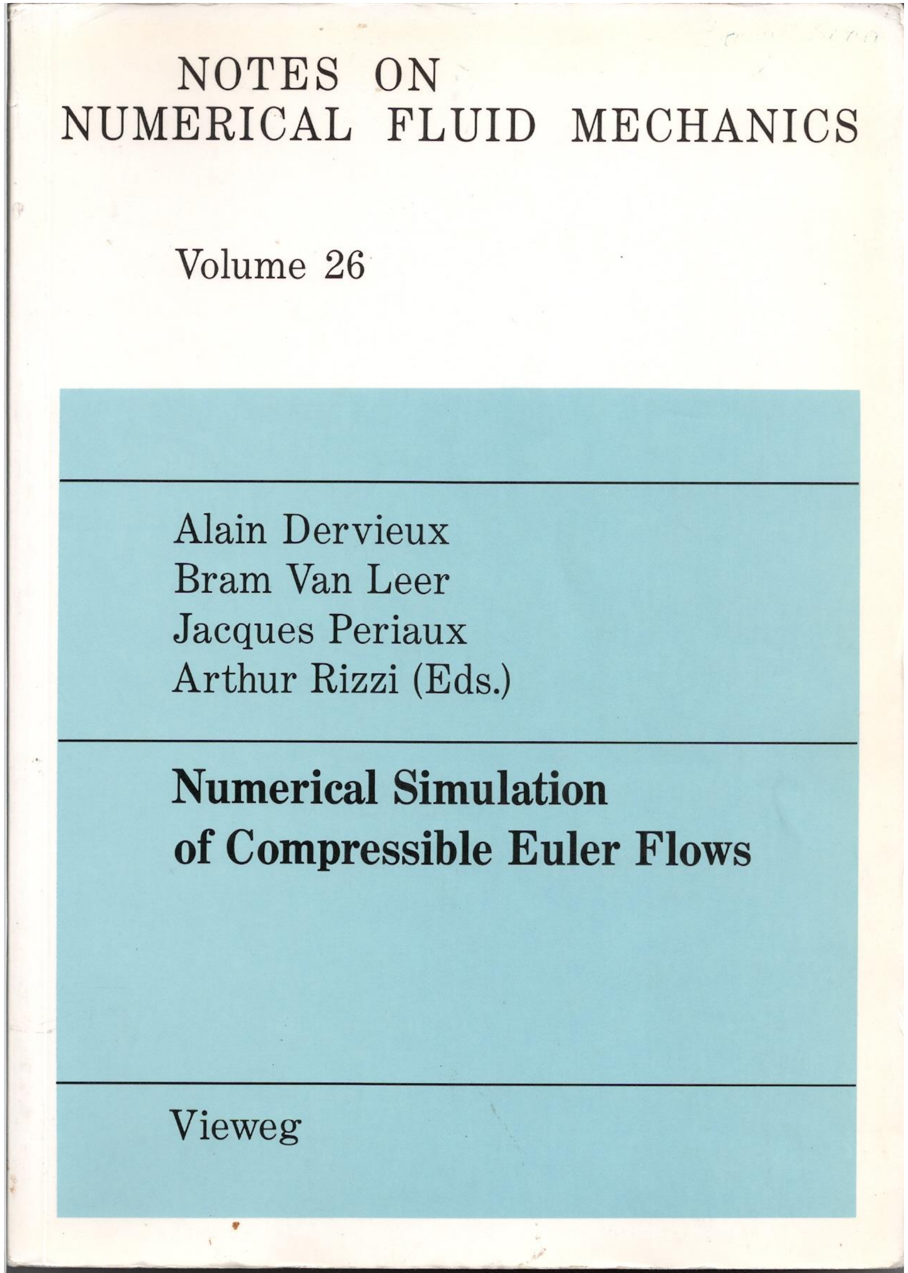
Thema 1.	J.J. Chattot, Matra Industries, Velizy
	B. van Leer, Technische Hogeschool Delft
	H. Viviand, ONERA, Parijs
Thema 2.	R. Beauwens, Vrije Universiteit Brussel
	J. Periaux, Avions Marcel Dassault, Parijs
	D.M. Young, University of Texas, Austin
	G. Golub, Stanford University (onder voorbehoud)

De Heer Chattot komt in de plaats van Temam. Op het gebied van de Euler-vergelijkingen werkt hij samen met de groep van Prof. Temam.

Tijdens de laatste fase van de voorbereidingen is gebleken dat Prof. Golub rond half oktober zal deelnemen aan een conferentie in Leuven. Dit was voor de organisatiecommissie aanleiding hem uit te nodigen ook een voordracht in Zeist te verzorgen (binnen thema 2).

A.O.H. Axelsson en H. Schippers hebben zich aangemeld voor een korte bijdrage.

INRIA, 1986


NOTES ON
NUMERICAL FLUID MECHANICS

Volume 26

Alain Dervieux
Bram Van Leer
Jacques Periaux
Arthur Rizzi (Eds.)

Numerical Simulation of Compressible Euler Flows

Vieweg

Hermes, 1987

Delft, 1989

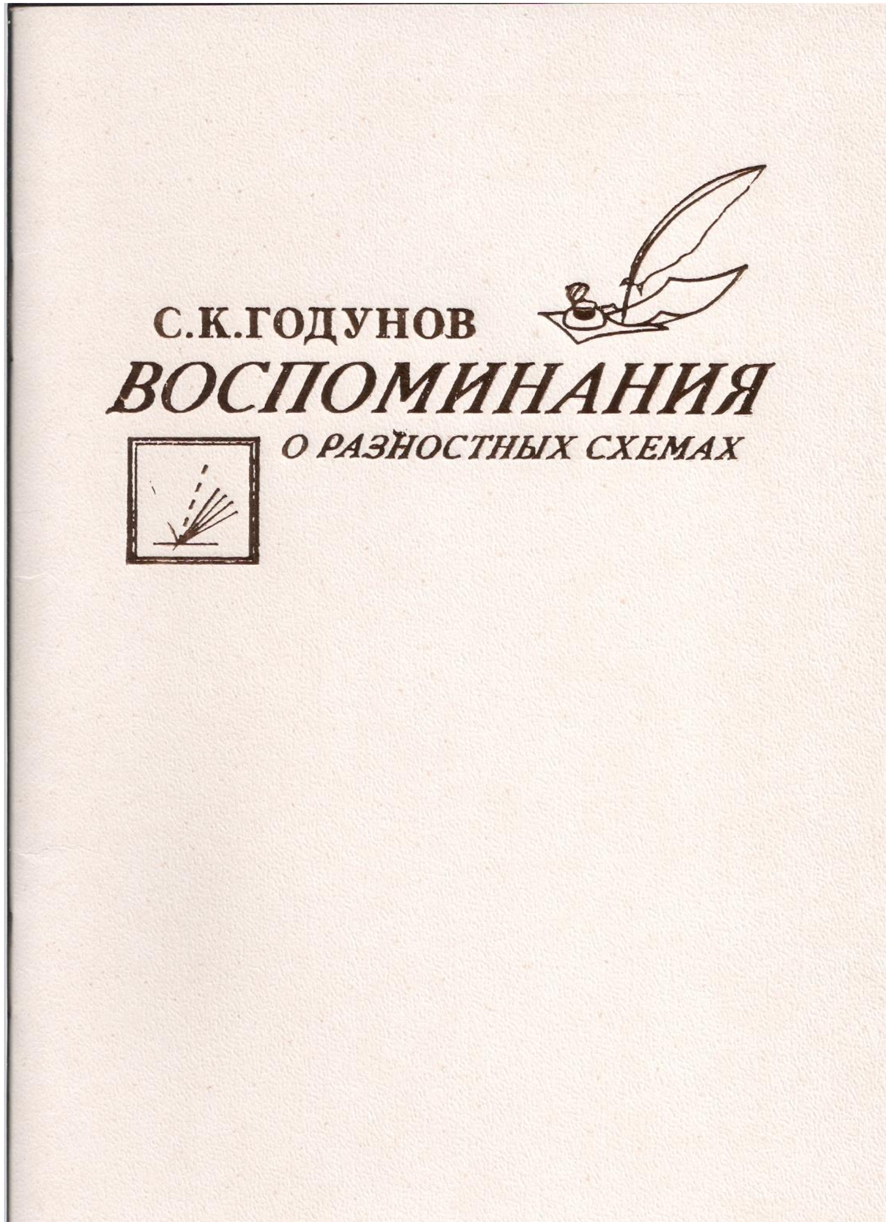
Delft, 1989

San Diego, 1995

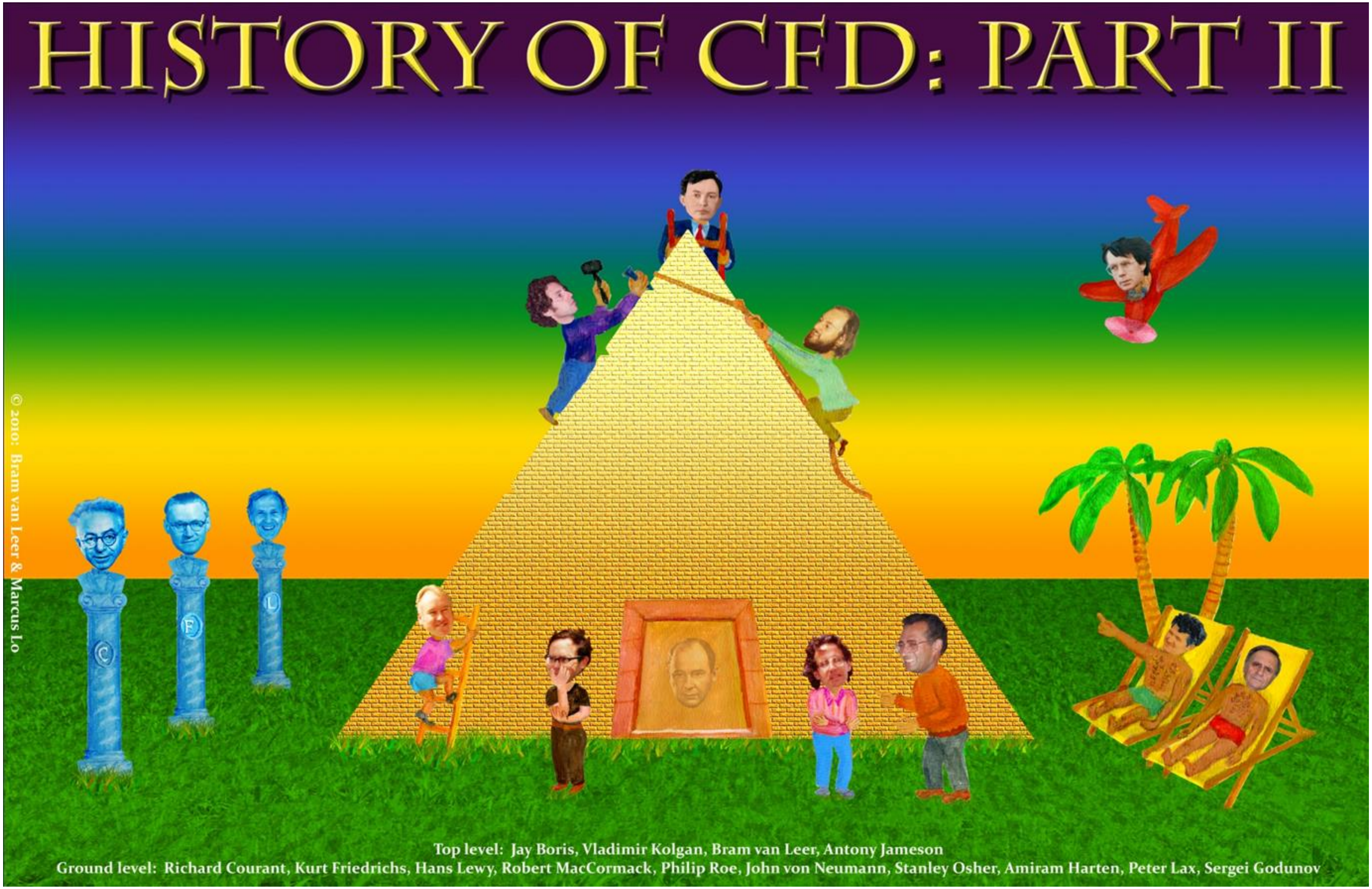
Ann Arbor, 1996

Ann Arbor, 1997

Ann Arbor, 1997



AIAA, Chicago, 2010



CWI, 1993-2007

Leiden, 2012

Leiden, 2012

Leiden, 2012

Leiden, 2012

Van Leer Family, 2006

Van Leer Family, 2008

You're welcome!