

A METHODOLOGY TO VALIDATE 3D ARBITRARY LAGRANGIAN EULERIAN CODES WITH APPLICATIONS TO ALEGRA

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Summary—In this study we provided an experimental test bed for validating features of the Arbitrary Lagrangian Eulerian Grid for Research Applications (ALEGRA) code over a broad range of strain rates with overlapping diagnostics that encompass the multiple responses. A unique feature of the ALEGRA code is that it allows simultaneous computational treatment, within one code, of a wide range of strain-rates varying from hydrodynamic to structural conditions. This range encompasses strain rates characteristic of shock-wave propagation ($10^7/s$) and those characteristics of structural response ($10^2/s$). Most previous code validation experimental studies, however, have been restricted to simulating or investigating a single strain-rate regime. What is new and different in this investigation is that we have performed well-controlled and well-instrumented experiments, which capture features relevant to both hydrodynamic and structural response in a single experiment. Aluminum was chosen for use in this study because it is a well-characterized material. The current experiments span strain rate regimes of over $10^7/s$ to less than $10^2/s$ in a single experiment. The input conditions were extremely well defined. Velocity interferometers were used to record the high strain-rate response, while low strain rate data were collected using strain gauges. Although the current tests were conducted at a nominal velocity of ~ 1.5 km/s, it is the test methodology that is being emphasized herein. Results of a three-dimensional experiment are also presented.

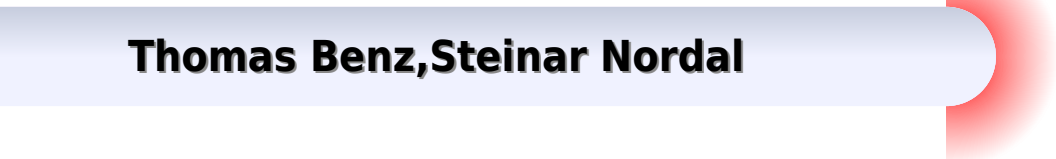
INTRODUCTION

Sandia National Laboratories is developing a code referred to as ALEGRA which is a multi-material arbitrary Lagrangian Eulerian code [1] for use in many programs related to research applications. A unique feature of ALEGRA is that it allows simultaneous computational treatment, within one code, of a wide range of strain-rates varying from encompasses strain rates characteristic of shock-wave propagation ($10^7/s$) and those characteristics of structural response ($10^2/s$) [2]. It combines the features of modern Eulerian codes such as CTH [3] with modern Lagrangian shock wave physics codes and transient structural analysis codes. Some examples of applications with varying strain rates include (but are not limited to) high velocity impact and penetration processes [4], explosively formed projectiles, and shaped charge jet formation.

Validating a code requires both postdating and predicting pertinent experimental data. The most useful validation experiments are reproducible and highly instrumented [5], with well-understood experimental errors. There are many parts of a calculation that we must validate: geometry, initial conditions, boundary conditions, material flow algorithms (remeshing and remapping algorithms), and material models, including EOS, constitutive relations and fracture models. There are also issues associated with meshing resolution and geometric fidelity. In many cases pertinent experimental data are available for a single strain rate regime and are used when appropriate to this regime. However, within certain applications that ALEGRA is

Arbitrary Lagrangian Computer Codes

Thomas Benz, Steinar Nordal



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Numerical Methods in Geotechnical Engineering Thomas Benz, Steinar Nordal, 2010-05-25 Numerical Methods in Geotechnical Engineering contains 153 scientific papers presented at the 7th European Conference on Numerical Methods in Geotechnical Engineering NUMGE 2010 held at Norwegian University of Science and Technology NTNU in Trondheim Norway 2 4 June 2010 The contributions cover topics from emerging research to engineering practice **Computational Mechanics '95** S.N. Atluri, G. Yagawa, Thomas A. Cruse, 2013-11-11 AI in the earlier conferences Tokyo 1986 Atlanta 1988 Melbourne 1991 and Hong Kong 1992 the response to the call for presentations at ICES 95 in Hawaii has been overwhelming A very careful screening of the extended abstracts resulted in about 500 papers being accepted for presentation Out of these written versions of about 480 papers reached the conference secretariat in Atlanta in time for inclusion in these proceedings The topics covered at ICES 95 range over the broadest spectrum of computational engineering science The editors thank the international scientific committee for their advice and encouragement in making ICES 95 a successful scientific event Special thanks are expressed to the International Association for Boundary Elements Methods for hosting IABEM 95 in conjunction with ICES 95 The editors here express their deepest gratitude to Ms Stacy Morgan for her careful handling of a myriad of details of ICES 95 often times under severe time constraints The editors hope that the readers of this proceedings will find a kaleidoscopic view of computational engineering in the year 1995 as practiced in various parts of the world Satya N Atluri Atlanta Georgia USA Genki Yagawa Tokyo Japan Thomas A Cruse Nashville TN USA Organizing Committee Professor Genki Yagawa University of Tokyo Japan Chair Professor Satya Atluri Georgia Institute of Technology U S A *Nuclear Science Abstracts*, 1973 NSA is a comprehensive collection of international nuclear science and technology literature for the period 1948 through 1976 pre dating the prestigious INIS database which began in 1970 NSA existed as a printed product Volumes 1 33 initially created by DOE's predecessor the U S Atomic Energy Commission AEC NSA includes citations to scientific and technical reports from the AEC the U S Energy Research and Development Administration and its contractors plus other agencies and international organizations universities and industrial and research organizations References to books conference proceedings papers patents dissertations engineering drawings and journal articles from worldwide sources are also included Abstracts and full text are provided if available [GASFLOW-MPI: A Scalable Computational Fluid Dynamics Code for Gases, Aerosols and Combustion. Band 1 \(Theory and Computational Model \(Revision 1.0\)\)](#) Xiao, Jianjun, Travis, Jack, Royle, Peter, Necker, Gottfried, Svishchev, Anatoly, Jordan, Thomas, 2016-04-06 Karlsruhe Institute of Technology KIT is developing the parallel computational fluid dynamics code GASFLOW MPI as a best estimate tool for predicting transport mixing and combustion of hydrogen and other gases in nuclear reactor containments and other facility buildings GASFLOW MPI is a finite volume code based on proven computational fluid dynamics methodology that solves the compressible Navier Stokes equations for three dimensional volumes in Cartesian or cylindrical coordinates **Computational Optimization of**

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This book delves into Arbitrary Lagrangian Computer Codes. Arbitrary Lagrangian Computer Codes is an essential topic that must be grasped by everyone, from students and scholars to the general public. The book will furnish comprehensive and in-depth insights into Arbitrary Lagrangian Computer Codes, encompassing both the fundamentals and more intricate discussions.

1. This book is structured into several chapters, namely:
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 - Chapter 4: Arbitrary Lagrangian Computer Codes in Specific Contexts
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