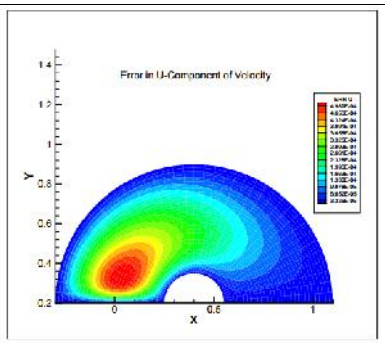
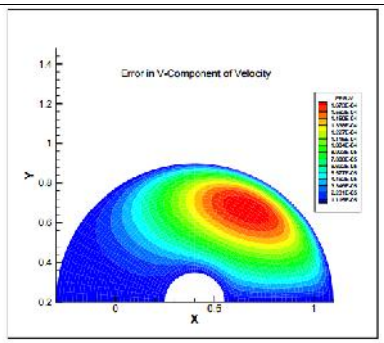
Verification type	Manufactured Solutions
Database reference	MAN-3
Topic / Application	Code Verification Manufactured Solutions Procedures
Physics	Incompressible Navier Stokes Burgers Equation
Summary	This document is a comprehensive description of the MMS applied to CFD problems. The focus of the paper is on highlighting coding mistakes.
Description	A procedure for code Verification by the Method of Manufactured Solutions (MMS) is presented. MMS is applied to a variety of engineering codes which numerically solve partial differential equations. This is illustrated by detailed examples from computational fluid dynamics. The MMS procedure is shown to identify any coding mistake that affects the order-of-accuracy of the numerical method. A set of examples which use a blind-test protocol demonstrates the kinds of coding mistakes that can (and cannot) be exposed via the MMS code Verification procedure. The principle advantage of the MMS procedure over traditional methods of code Verification is that code capabilities are tested in full generality. The procedure thus results in a high degree of confidence that all coding mistakes which prevent the equations from being solved correctly have been identified.
Case Title	Code Verification by the Method of Manufactured Solutions
Authors	Kambiz Salari and Patrick Knupp, Sandia National Laboratories
Year	2000
Online reference	SAND2000 – 1444
Case image	 

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	Example of the error in the solution of the 2-D Burgers equation (velocity components).
Governing equations	N/A
Results	The study shows the types of coding errors that can, and those that cannot, be exposed by the MMS technique.