

# Solution Manual

## Chapter 1

1.1 For the two-dimensional flow field defined by the velocity components  $v_x = \frac{1}{1+t}$ ,  $v_y = 1$ ,  $v_z = 0$ , find the Lagrangian representation of the paths taken by the fluid particles.

**Solution:** Since the velocities all are dependent on time and independent of position, the path lines taken are all straight lines. The position in the  $y$  direction changes linearly in time, while the position in the  $x$  direction does not change. In the  $x$  direction the position changes as  $\ln(1+t)$ . Thus a particle which at time  $t_0$  is at  $(X_0, Y_0, Z_0)$  will be at the position

$$(X, Y, Z) = (X_0, Y_0, Z_0) + \left( \ln \frac{1+t}{1+t_0}, t - t_0, 0 \right).$$

1.2 Find the acceleration at point  $(1, 1, 1)$  for the velocity  $\mathbf{v} = (yz + t, xz - t, xy)$ .

**Solution:**

$$\begin{aligned} \mathbf{v} &= (yz + t, xz - t, xy) \\ a_x &= \frac{\partial v_x}{\partial t} + v_x \frac{\partial v_x}{\partial x} + v_y \frac{\partial v_x}{\partial y} + v_z \frac{\partial v_x}{\partial z} \\ &= 1 + (yz + t) \cdot 0 + (xz - t) \cdot z + xy \cdot y = 1 + x(y^2 + z^2) - tz. \end{aligned}$$

1.3 a. Find the relationship between velocity components in cylindrical polar coordinates in terms of components in Cartesian coordinates, as well as the inverse relations. Use Figure 1.4.1.  
 b. Find the relationships between velocity components in spherical polar coordinates in terms of components in Cartesian coordinates, as well as the inverse relations. Use Figure 1.4.3.

# Advanced Fluid Mechanics Solution Manual

**Bernard Stanford Massey, Alfred John  
Ward-Smith**

## **Advanced Fluid Mechanics Solution Manual:**

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**Solutions Manual to Accompany Fluid Mechanics with Engineering Applications** Robert Long Daugherty,1985 Engineering Education ,1991 Graduate Catalog ... University of Nebraska at Omaha,1971

**Elements of Heat Transfer** Ethirajan Rathakrishnan,2012-03-05

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**Research Abstracts** ,1990 **Fundamentals of Fluid Mechanics** Bruce R. Munson,Donald F. Young,Theodore H.

Okiishi,1998 This students solutions manual accompanies the main text Each concept of fluid mechanics is considered in the book in simple circumstances before more complicated features are introduced The problems are presented in a mixture of SI and US standard units **Mechanics of Fluids** Bernard Stanford Massey,Alfred John Ward-Smith,2005 This solutions manual accompanies the 8th edition of Massey s Mechanics of Fluids the long standing and best selling textbook It provides a series of carefully worked solutions to problems in the main textbook suitable for use by lecturers guiding stud

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