

1.19

$$\mu \frac{d^2 u}{dy^2} = \frac{dp}{dx}$$

$$\frac{du}{dy} = \frac{1}{\mu} \frac{dp}{dx} y + C_1$$

$$u(y) = \frac{1}{\mu} \frac{dp}{dx} \frac{y^2}{2} + C_1 y + C_2$$

applying B.Cs $u(0) = 0$ and $u(H) = 0$

$$0 = 0 + 0 + C_2 \quad \text{and} \quad 0 = \frac{1}{\mu} \frac{dp}{dx} \frac{H^2}{2} + C_1 H$$

$$C_2 = 0 \quad \text{and} \quad C_1 = -\frac{H}{2\mu} \frac{dp}{dx}$$

$$\underline{u(y) = -\frac{1}{2\mu} \frac{dp}{dx} (Hy - y^2)}$$



note ^{because} Pressure drops in the direction of flow, $\frac{dp}{dx} < 0$ in velocity equation.

(a) $\mu \frac{d^2 u}{dy^2} = \frac{dp}{dx}$

$$u_{\text{assumed}} = C_1 \sin\left(\frac{\pi y}{H}\right)$$

note the assumed solution satisfies the boundary conditions.

$$\frac{du}{dy} = \frac{d}{dy} \left(C_1 \sin\left(\frac{\pi y}{H}\right) \right) = C_1 \frac{\pi}{H} \cos\left(\frac{\pi y}{H}\right)$$

$$\frac{d^2 u}{dy^2} = \frac{d}{dy} \left(C_1 \frac{\pi}{H} \cos\left(\frac{\pi y}{H}\right) \right) = -C_1 \left(\frac{\pi}{H}\right)^2 \sin\left(\frac{\pi y}{H}\right)$$

$$\mu \left[-C_1 \left(\frac{\pi}{H}\right)^2 \sin\left(\frac{\pi y}{H}\right) \right] - \frac{dp}{dx} = 0$$

We may force the error function to equal zero at $y = \frac{H}{2}$

$$\mu \left[-C_1 \left(\frac{\pi}{H}\right)^2 \sin\left(\frac{\pi}{2}\right) \right] - \frac{dp}{dx} = 0$$

$$C_1 = -\frac{H^2}{\mu \pi^2} \frac{dp}{dx}$$

$$\text{then, } \underline{u(y) = -\frac{H^2}{\mu \pi^2} \frac{dp}{dx} \left(\sin\left(\frac{\pi y}{H}\right) \right)}$$



Solution Manual For Finite Element Analysis Moaveni

**Sez Atamturktur, Tyler
Schoenherr, Babak Moaveni, Costas
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The Finite Element Method Darrell W. Pepper,Juan C. Heinrich,2017-04-11 This self explanatory guide introduces the

basic fundamentals of the Finite Element Method in a clear manner using comprehensive examples Beginning with the concept of one dimensional heat transfer the first chapters include one dimensional problems that can be solved by inspection The book progresses through more detailed two dimensional elements to three dimensional elements including discussions on various applications and ending with introductory chapters on the boundary element and meshless methods where more input data must be provided to solve problems Emphasis is placed on the development of the discrete set of algebraic equations The example problems and exercises in each chapter explain the procedure for defining and organizing the required initial and boundary condition data for a specific problem and computer code listings in MATLAB and MAPLE are included for setting up the examples within the text including COMSOL files Widely used as an introductory Finite Element Method text since 1992 and used in past ASME short courses and AIAA home study courses this text is intended for undergraduate and graduate students taking Finite Element Methodology courses engineers working in the industry that need to become familiar with the FEM and engineers working in the field of heat transfer It can also be used for distance education courses that can be conducted on the web Highlights of the new edition include Inclusion of MATLAB MAPLE code listings along with several COMSOL files for the example problems within the text Power point presentations per chapter and a solution manual are also available from the web Additional introductory chapters on the boundary element method and the meshless method Revised and updated content Simple and easy to follow guidelines for understanding and applying the Finite Element Method

Fundamentals of the Finite Element Method Hartley Grandin,1986 **Finite Element Analysis Theory and Application with ANSYS, 3/e** Saeed Moaveni,2011 **Problems and Solutions in Finite Element Analysis** CRC Press,David W Nicholson,2008-06-01 **Finite Element Method** Sinan Muftu,2022-07-14

Finite Element Method Physics and Solution Methods aims to provide the reader a sound understanding of the physical systems and solution methods to enable effective use of the finite element method This book focuses on one and two dimensional elasticity and heat transfer problems with detailed derivations of the governing equations The connections between the classical variational techniques and the finite element method are carefully explained Following the chapter addressing the classical variational methods the finite element method is developed as a natural outcome of these methods where the governing partial differential equation is defined over a subsegment element of the solution domain As well as being a guide to thorough and effective use of the finite element method this book also functions as a reference on theory of elasticity heat transfer and mechanics of beams Covers the detailed physics governing the physical systems and the computational methods that provide engineering solutions in one place encouraging the reader to conduct fully informed finite element analysis Addresses the methodology for modeling heat transfer elasticity and structural mechanics problems Extensive worked examples are provided to help the reader to understand how to apply these methods in practice

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