

# Vector Mechanics For Engineers Statics And Dynamics By Ferdinand P Beer 2003 08 01

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### Vector Mechanics For Engineers Statics

#### VECTOR MECHANICS FOR ENGINEERS: STATICS

1 VECTOR MECHANICS FOR ENGINEERS: STATICS Ninth Edition Ferdinand P Beer E Russell Johnston, Jr Lecture Notes: J Walt Oler Texas Tech University

#### VECTOR MECHANICS FOR ENGINEERS: 2 STATICS

Eighth Vector Mechanics for Engineers: Statics Edition 2 - 15 Rectangular Components of a Force: Unit Vectors • Vector components may be expressed as products of the unit vectors with the scalar magnitudes of the vector components  $F_x$  and  $F_y$  are referred to as the scalar components of  $F$   $F_x i + F_y j$   $r = r_x i + r_y j$  • May resolve a force vector

#### Vector Mechanics For Engineers: Statics, 11th Edition Ebooks

Vector Mechanics For Engineers: Statics, 11th Edition Ebooks A primary objective in a first course in mechanics is to help develop a student's ability first to analyze problems in a simple and logical manner, and then to apply basic principles to their solutions A strong conceptual understanding of these basic mechanics principles is essential for successfully solving ...

#### VECTOR MECHANICS FOR ENGINEERS: STATICS

Vector Mechanics for Engineers: Statics Edition 3 - 39 Sample Problem 31 a) Moment about O is equal to the product of the force and the perpendicular distance between the line of action of the force and O Since the force tends to rotate the lever clockwise, the moment vector is into the plane of the paper

### **VECTOR MECHANICS FOR ENGINEERS: 3 STATICS**

Eighth Vector Mechanics for Engineers: Statics Edition 3 - 8 Moment of a Force About a Point • A force vector is defined by its magnitude and direction Its effect on the rigid body also depends on its point of application • The moment of F about O is defined as  $M_O = r \times F$  • The moment vector  $M_O$  is perpendicular to the plane containing O

### **VECTOR MECHANICS FOR ENGINEERS: STATICS**

h Vector Mechanics for Engineers: Statics n Application of Vector Addition 2 - 4 Three concurrent forces are acting on the hook due to the chains Will the hook bend or break? To answer this question, the resultant force acting on the hook needs to be calculated

### **Vector Mechanics for Engineers: Statics**

• A force vector is defined by its magnitude and direction Its effect on the rigid body also depends on its line of action • The moment of F about O is defined as  $M_O = r \times F$  • The moment vector  $M_O$  is perpendicular to the plane containing O and the force F • Any force F' that has the same magnitude and direction as F, is equivalent if it also has the same line of action and therefore

### **CHAPTER VECTOR MECHANICS FOR ENGINEERS: STATICS**

Eighth Vector Mechanics for Engineers: Statics Edition 3 - 6 Vector Product of Two Vectors • Concept of the moment of a force about a point is more easily understood through applications of the vector product or cross product • Vector product of two vectors P and Q is defined as the vector V which satisfies the following conditions: 1

### **CHAPTER VECTOR MECHANICS FOR ENGINEERS: STATICS**

Eighth Vector Mechanics for Engineers: Statics Edition 4 - 3 Introduction • The necessary and sufficient condition for the static equilibrium of a body are that the resultant force and couple from all external forces form a system equivalent to zero,  $\sum F = 0$  and  $\sum M = 0$

### **CHAPTER VECTOR MECHANICS FOR ENGINEERS: STATICS**

Vector Mechanics for Engineers: Statics Edition 7 - 7 Shear and Bending Moment in a Beam • Wish to determine bending moment and shearing force at any point in a beam subjected to concentrated and distributed loads • Determine reactions at supports by treating whole beam as free-body • Cut beam at C and draw free-body diagrams for AC and CB By

### **VECTOR MECHANICS FOR ENGINEERS: STATICS**

Eighth Vector Mechanics for Engineers: Statics Edition Rectangular Components of a Force: Unit Vectors • May resolve a force vector into perpendicular components so that the resulting parallelogram is a rectangle are referred to as rectangular vector components and  $F = F_x i + F_y j$  • Define perpendicular unit vectors

### **Vector Mechanics for Engineers: Statics**

Eighth Vector Mechanics for Engineers: Statics Edition 3 - 3 Analysis of Trusses by the Method of Sections • When the force in only one member or the forces in a very few members are desired, the method of sections works well • To determine the force in member BD, pass a section through the truss as shown and create

### **CHAPTER 2**

PROBLEM 25 A stake is being pulled out of the ground by means of two ropes as shown Knowing that  $30^\circ$ , determine by trigonometry (a) the magnitude of the

### CHAPTER VECTOR MECHANICS FOR ENGINEERS: STATICS

h Vector Mechanics for Engineers: Statics dition Free-Body Diagram 4 - 4 First step in the static equilibrium analysis of a rigid body is identification of all forces acting on the body with a free-body diagram • Select the extent of the free-body and detach it from the ground and all other bodies

• Include the dimensions necessary to compute

### Engineering Mechanics: Statics

we use an arrow above a symbol to indicate that the symbol represents a vector quantity For example,  $\vec{A}$  (handwritten) refers to the vector  $A$  Of course, you should use the notation for vectors with which you are comfortable However, it is important that you clearly, and consistently, indicate the symbols that represent vector quantities

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### CHAPTER VECTOR MECHANICS FOR ENGINEERS: STATICS

Vector Mechanics for Engineers: Statics Introduction 4 - 4 • The necessary and sufficient conditions for the static equilibrium of a body are that the forces sum to zero, and the moment about any point sum to zero:  $\sum \mathbf{F} = 0$   $\sum \mathbf{M}_O = \sum (\mathbf{r} \times \mathbf{F}) = 0$  ! ! ! • Equilibrium analysis can be applied to two-dimensional or three-

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### CHAPTER VECTOR MECHANICS FOR ENGINEERS: STATICS

Vector Mechanics for Engineers: Statics n Rectilinear Motion: Position, Velocity & Acceleration 11 - 4 • Particle moving along a straight line is said to be in rectilinear motion • Position coordinate of a particle is defined by positive or negative distance of particle from a fixed origin on the line • The motion of a particle is known

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