# Chapter 3 Introduction Transcript

### 0:01

For this Chapter 3 introduction, we are going to talk about equilibrium analysis in extended body systems. This is different from concurrent force systems. We will take what we learned from concurrent force systems and add a new component. We still sum all the forces and set them equal to zero, just as before, but now we also have to consider moments. We must consider moments because we are no longer dealing with a concurrent force system. Some of the forces will cause moments. Until now, we have treated moments as a simple idea, but in reality, they are more complex. We will break moments into several topics and several ways to analyze them.

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The major decision you need to make is whether you will calculate moments using scalar calculations-regular equations without vectors-or vector operations, specifically the cross product, to calculate the moment of a force. Both approaches determine the moment about a particular point. The moment about any point must be equal to zero if the body is in equilibrium. Generally, scalar calculations are better for 2D systems, while vector calculations are better for 3D systems.

### 1:37

With scalar calculations, we will also use Varignon's Theorem. Just as we previously broke forces into x and y components, we will do the same here. Breaking forces into x and y components makes calculating the sum of multiple moments much easier. Using Varignon's Theorem, we break down the forces and find the moment of each component individually.

### 2:09

With vector calculations, we can also find the moment about a particular axis. This is straightforward if the axis is simply the x-axis or y-axis-we just extract the appropriate component from the moment-about-a-point calculation. But if we have something like a hinge or a shaft that does not align with the coordinate axes, we can use the dot product, another vector operation, to find the moment about that specific axis.

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### 2:50

The last topic involving moments is couples. A couple is a set of equal and opposite forces that are not collinear. Because they do not line up, they cause rotation. However, since the forces are equal and opposite, they do not cause linear acceleration. A couple is sometimes called a pure moment because it causes rotation without causing linear acceleration.

### 3:22

We now have several options for analyzing moments. Depending on the problem and the equilibrium analysis, we may choose one method over another. All of these approaches contribute to equilibrium analysis for an extended body. Just as before, we will sum the forces, but now we add the requirement that the sum of the moments must also be equal to zero if the body is in equilibrium. If there is no angular acceleration, the sum of the moments must be zero.

### 3:59

That concludes our introduction for Chapter 3. Thank you for watching.