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In this Chapter 2 introduction, we are going to talk about static equilibrium, specifically static equilibrium in concurrent force systems. The idea of static equilibrium is that the object is not accelerating. If we remember Newton's Second Law, which states that force equals mass times acceleration, then if the acceleration is zero, the forces must add up to zero. That is the idea of static equilibrium.

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If we want to use that in a useful way to find unknown forces in our system, we use the fact that the forces sum to zero. Finding those unknown forces by knowing that the forces sum to zero is known as equilibrium analysis. We will use the idea of static equilibrium to find unknown forces.

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In equilibrium analysis, we start with free body diagrams. This is where we draw our body and all the forces acting on that body - and nothing else. Then we remember that the sum of the forces must equal zero. Forces are not just numbers; they have both magnitude and direction. Pushing something to the left is not the same as pushing something to the right, or pushing up or down, or at an angle. A force is a vector, so we must consider both magnitude and direction. In equilibrium analysis, we need vector equations, so the sum of all force vectors must equal zero.

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That is the basis of equilibrium analysis. We also have equilibrium analysis for concurrent force systems. What is a concurrent force system, and why do we care about it? We have point forces, which are forces represented by a single vector. We can use something called the principle of transmissibility. If we have a force vector, it has a line of action - the line going through the vector in the same direction as the force. The principle of transmissibility states that we can move that force vector anywhere along its line of action without changing the analysis.

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If we can do that, and we have a concurrent force system - systems where all lines of action intersect at a single point - then all forces come together at one point. If we move all those forces to that one point, we essentially have a particle. All forces act at this single point. When everything acts at that single point, the moments on the body must equal zero because there is no moment arm around that point.

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So, if we have a concurrent force system, through this chain of logic, we do not need to worry about moments. We only worry about the forces to start with. Later on, when we do not have concurrent force systems, we will worry about moments again.

3:24

That is all for this video introduction. Thank you for watching.