Chapter 4 Introduction Transcript

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In this chapter, we are going to focus on statically equivalent systems. A statically equivalent system is one in which the forces and the moments cause the same effects. If two different sets of forces and moments would cause the same reaction forces, or the same linear and angular accelerations, those two sets of forces are known as statically equivalent systems. They are interchangeable for statics problems.

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What do we do with sets of forces that are statically equivalent? We build on this idea in two ways. First, we work on simplifying systems. Before that, we discuss what is known as the resolution of a force into a force and a couple. If we want to find a statically equivalent version of a force at a different location, we use this process. The resolution of a force removes the force from its original location, which changes the moment. A pure moment is called a couple, created by equal and opposite forces with no net force but a resulting moment. When we move a force, we correct the point of application by adding a couple to the system.

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If we have a set of forces and want to simplify it, we use the resolution of a force to find the equivalent force-couple system. Using this method, we take forces acting at different locations and move them, using the resolution process, to a single point. Once everything acts at a single point, we can sum them to find a single force and a single pure moment that are equivalent to a much larger and more complex system. This allows us to simplify complex systems into very simple systems consisting of one force and one couple.

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We also use statically equivalent systems with distributed forces. Forces can be broken down into point forces and distributed forces. Distributed forces are difficult to work with directly because they often require calculus. In statics, we convert distributed forces into their equivalent point load. The equivalent point load is a single point force that is statically equivalent to the distributed force. This converts a more complicated load into a simpler one that we can use in equilibrium equations.

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When working with equivalent point loads, we also look closely at centroids. Centroids and equivalent point load calculations are closely related, and we can use centroids as a method for finding the equivalent point load.

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These are the topics we will cover in the statically equivalent systems chapter of this book. Thank you for listening.