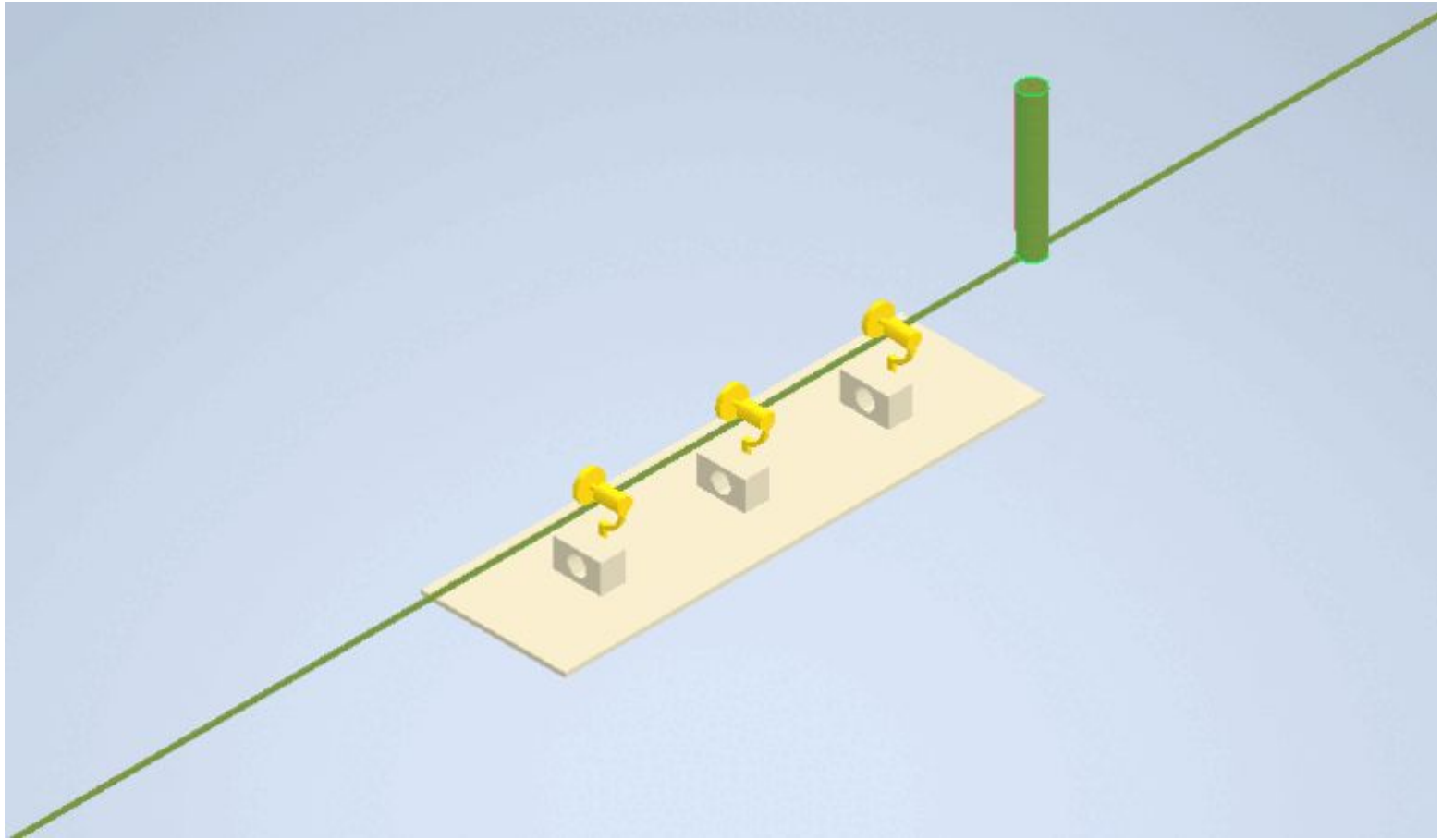
High-Voltage Electrical Transmission Line Inspection Robot

Problem Statement

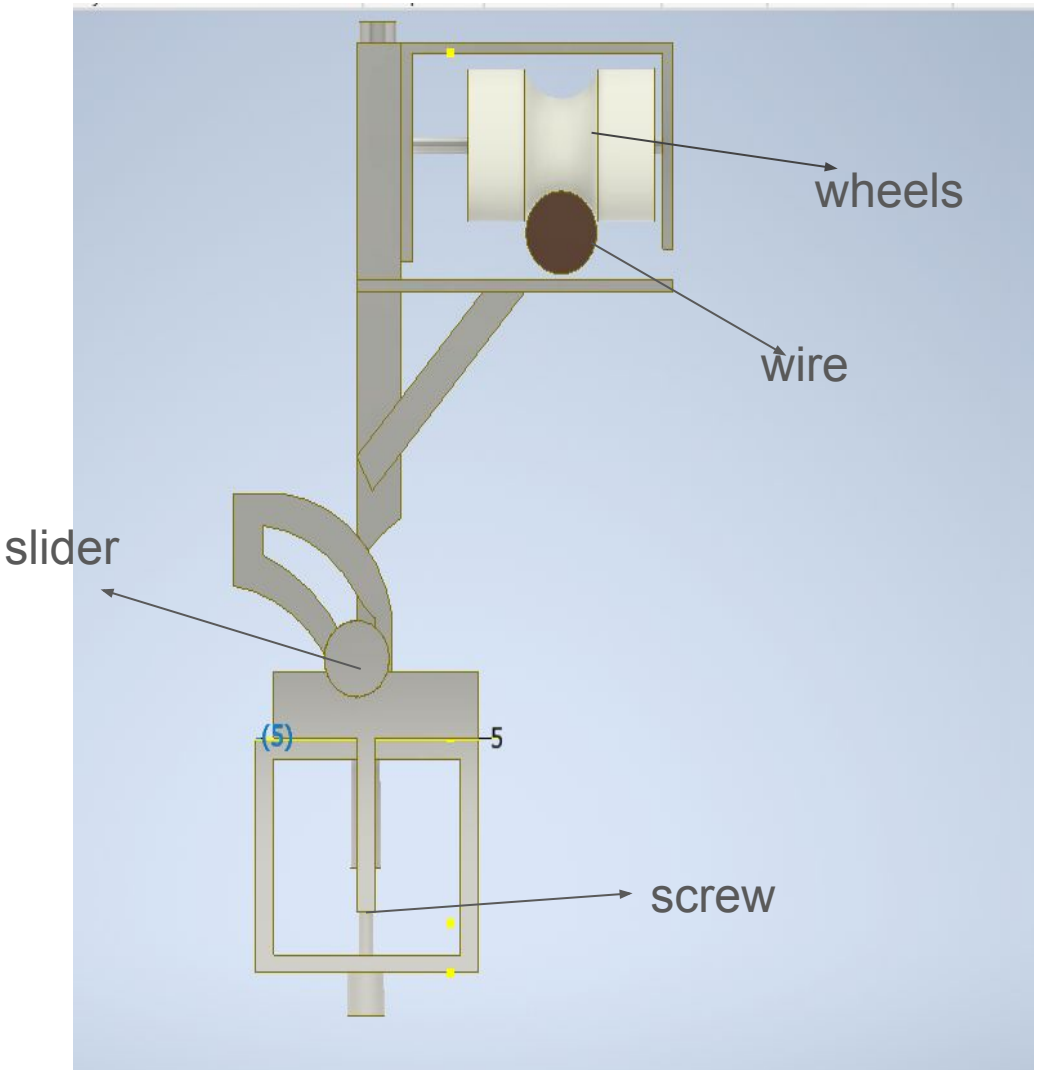
Design a robotic device that can autonomously inspect high-voltage transmission wires, reducing human intervention and risk. The robot must:

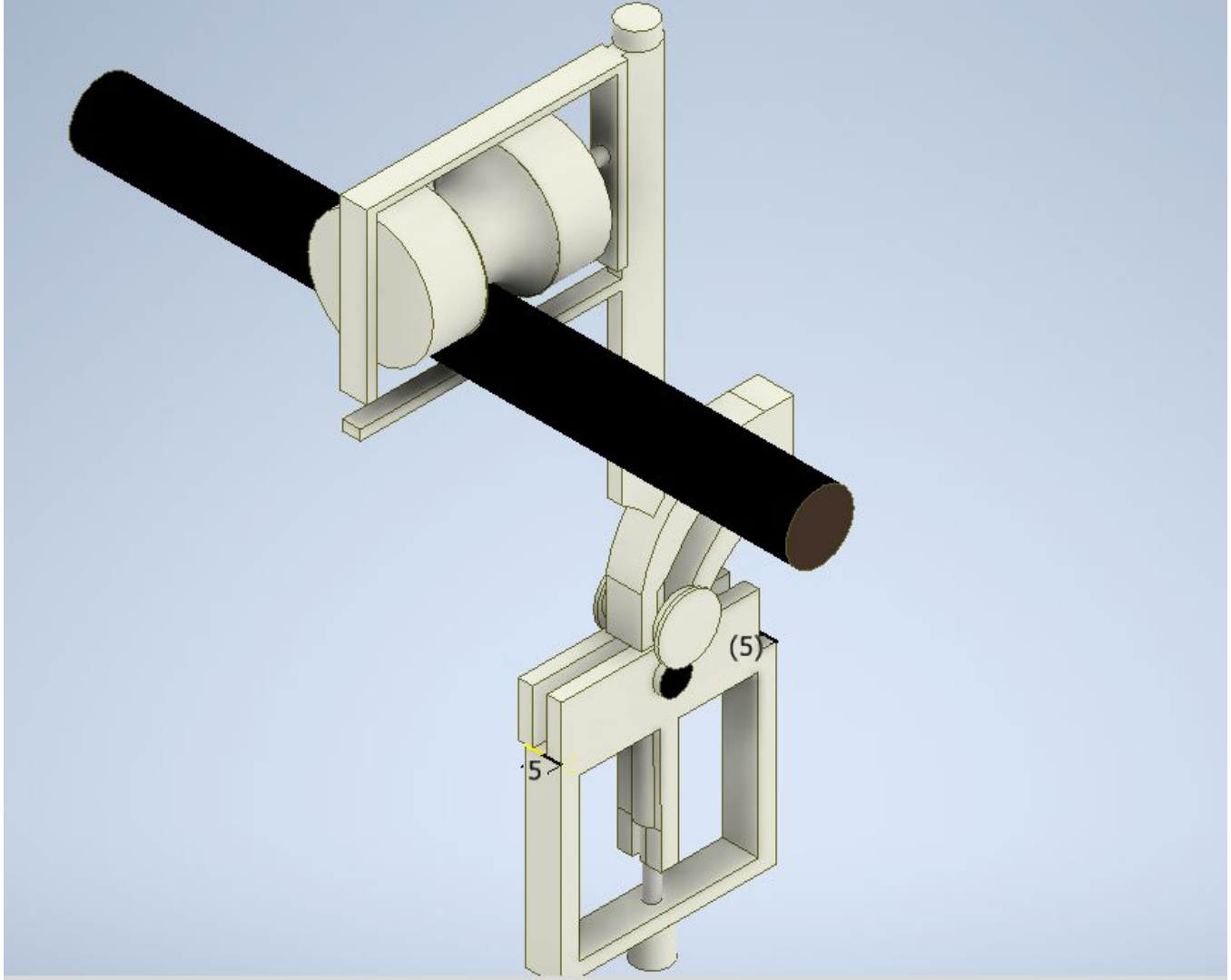
- **Traverse wires** while smoothly overcoming obstacles like insulators and junctions.
- **Use sensors** to inspect the wire condition.
- **Engage and disengage wheels** without causing vibrations on the wire.
- **Maintain stability** with a robust design, utilizing a single motor for both driving and wheel control.

Basic Principle



Cad model

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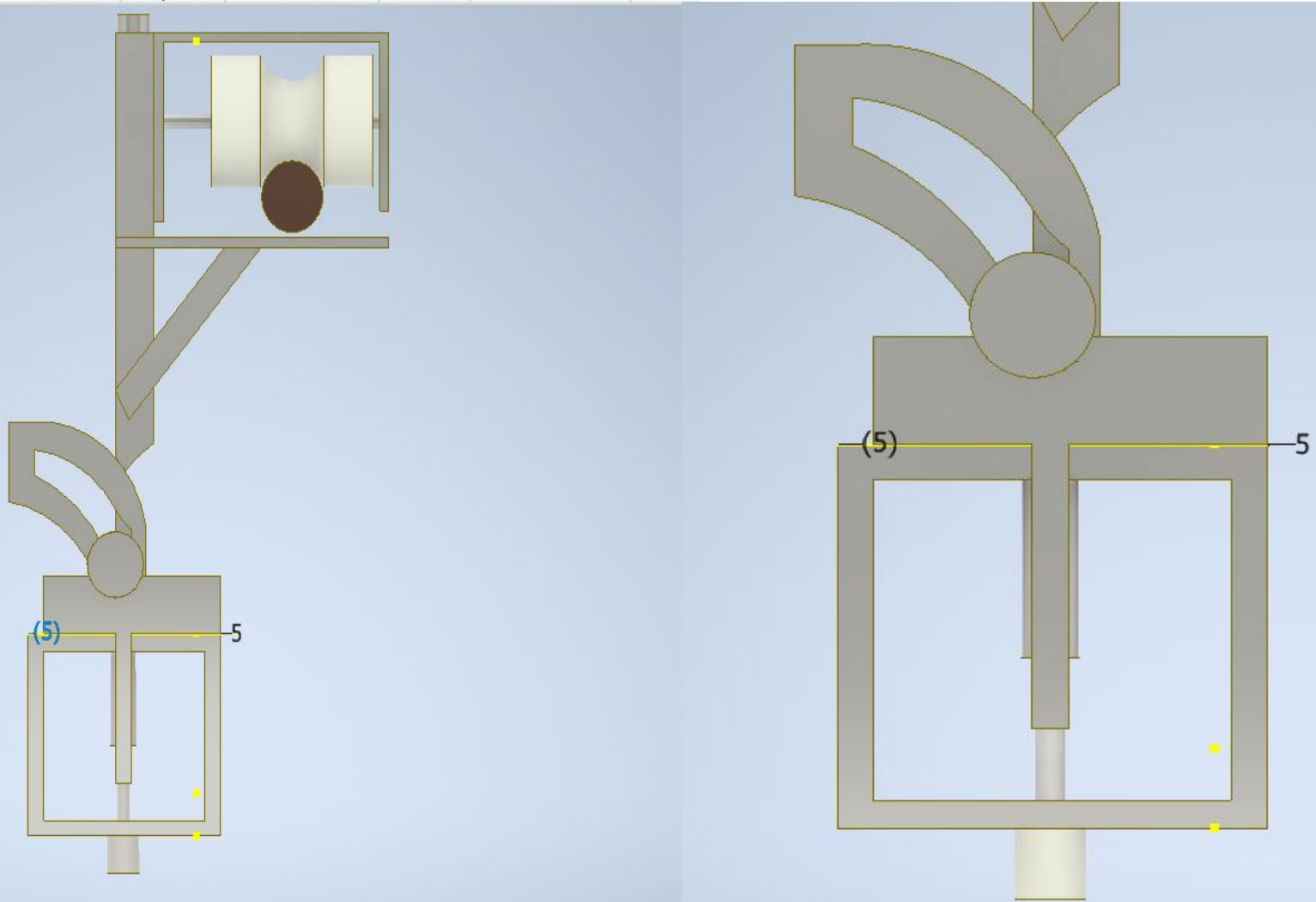
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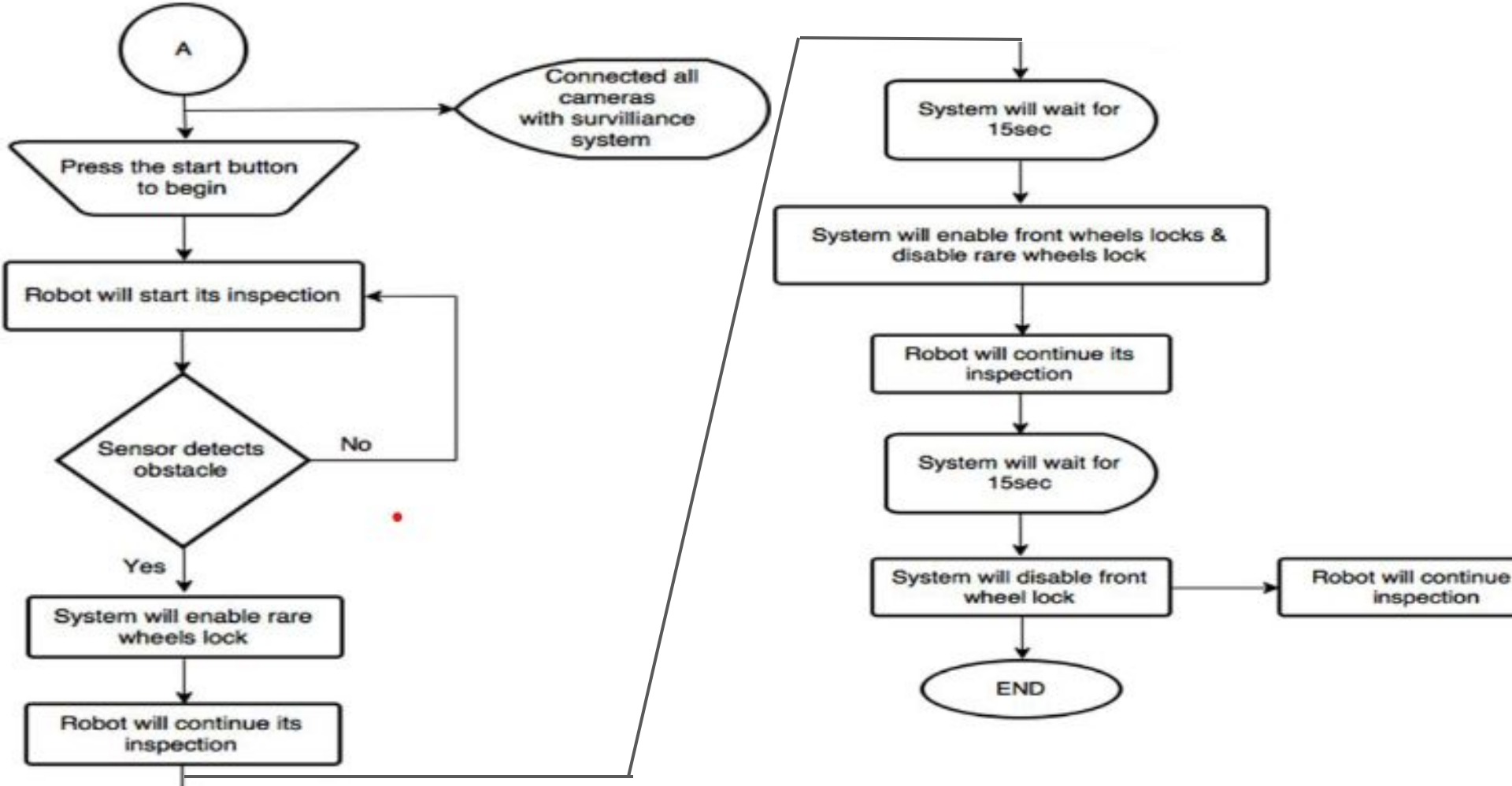
BLOCK DIAGRAM



Torque Calculation

Given the following relationships:

1. **Force equation** along the incline:

$$ma = f - mg\sin\theta$$

This describes the net force acting along the incline.

2. **Torque equation**:

$$T = fR$$

This relates the torque to the friction force f and the radius R of the wheel.

Step-by-Step Solution:

1. From the **force equation** $ma = f - mg\sin\theta$, solve for f:

$$f = ma + mg\sin\theta$$

2. Now, substitute this expression for f into the **torque equation** $T = fR$:

$$T = (ma + mg\sin\theta)R$$

Thus, the **torque T** in terms of mass m, acceleration a, gravitational force mg, incline angle θ, and the wheel's radius R is:

$$T = R\,(ma + mg\sin\theta)$$