

In the 1968 movie *Bullitt* there was an iconic San Francisco chase scene. Steve McQueen’s **Ford Mustang** was filmed with a camera recording at **24 frames per second (fps)**. See a clip at <https://www.youtube.com/watch?v=hq8YD7-Aimw>

The Car Specs:

- **Wheel Design:** American Racing "Torq Thrust" wheels with **5 identical spokes**.
- **Tire Radius: 13 inches** (0.33 meters).
- **Vehicle Speed: 60 mph** (approx. 26.82 m/s).

The Problem:

1. **Calculate the wheel's real rotational frequency** in revolutions per second (Hz).
2. **Find the rotation per frame** and determine the **fractional spoke displacement**.
3. **Predict the Apparent Spoke Speed** as seen by the camera in **Revolutions Per Minute (RPM)**.
4. Will the wheels appear to spin forward, backward, or look frozen?

Solution

Step 1: Find the Wheel's Real Rotation

- Calculate the circumference (m): _____
- Find the (Real) Rotational Frequency (Hz): _____

Step 2: Find the Spoke Frequency

- For 5 spokes (spokes/s): _____

Step 3: Calculate Aliasing (per frame)

- Determine number of spokes per frame [(spokes/s)/fps]: _____
- The whole number is ignored by the camera. The fractional part is: _____

Step 4: Predict Direction and Apparent Speed

- **Direction:** If the fractional part > **0.5**, the wheel will appear to spin **BACKWARD**. _____
- **Apparent Frequency:** The "perceived" jump in the spoke fraction. _____
- **Convert to RPM:**
 - Perceived Spoke Hz (or, spokes/s) using fps: _____
 - Perceived Wheel Hz (rev/s) divide by # spokes: _____
 - **Final RPM:** (convert time) _____