Lecture Comprehension, Configuration and Velocity Constraints (Chapter 2.4)

TOTAL POINTS 4

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1. True or false? A nonholonomic constraint implies a configuration constraint. **1 / 1 point**

   - ○ True.
   - ◉ False.

   Correct
   A nonholonomic constraint is a velocity constraint that cannot be integrated to a configuration constraint.

2. True or false? A Pfaffian velocity constraint is necessarily nonholonomic. **1 / 1 point**

   - ○ True.
   - ◉ False.

   Correct
   A Pfaffian velocity constraint can be nonholonomic (nonintegrable), or it can be the derivative of a holonomic configuration constraint.

3. A wheel moving in free space has the six degrees of freedom of a rigid body. If we constrain it to be upright on a plane (no "leaning") and to roll without slipping, how many holonomic and nonholonomic constraints is the wheel subject to? **1 / 1 point**

   - ◉ Two holonomic constraints and two nonholonomic constraints.
   - ○ Three holonomic constraints and zero nonholonomic constraints.
   - ○ Zero holonomic constraints and three nonholonomic constraints.
   - ○ One holonomic constraint and two nonholonomic constraints.

   Correct
   Two holonomic constraints (1) make the wheel upright and (2) put it in contact with the plane. This means that the C-space has 4 degrees of freedom (6 dof of a rigid body minus 2 constraints equals 4 dof), which could be described by 2 variables describing the contact point on the plane ($\mathbb{R}^2$), 1 variable describing the heading direction (S^1), and 1 variable describing which point on the boundary of the wheel is in contact with the ground (S^1), for a C-space of $\mathbb{R}^2 \times T^2$. The two nonholonomic constraints relate the x and y linear velocities to the rolling speed and heading

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4. How many degrees of freedom does the upright wheel on the plane have? (What is the minimum number of coordinates needed to describe its configuration?)

1 / 1 point

Preview

4

4

✓ **Correct**

Two variables specify the contact point on the plane, a third specifies the point on the wheel in contact with the ground, and a fourth specifies the heading direction of the wheel.