Steering Modes Available with A Crab-Drive Design

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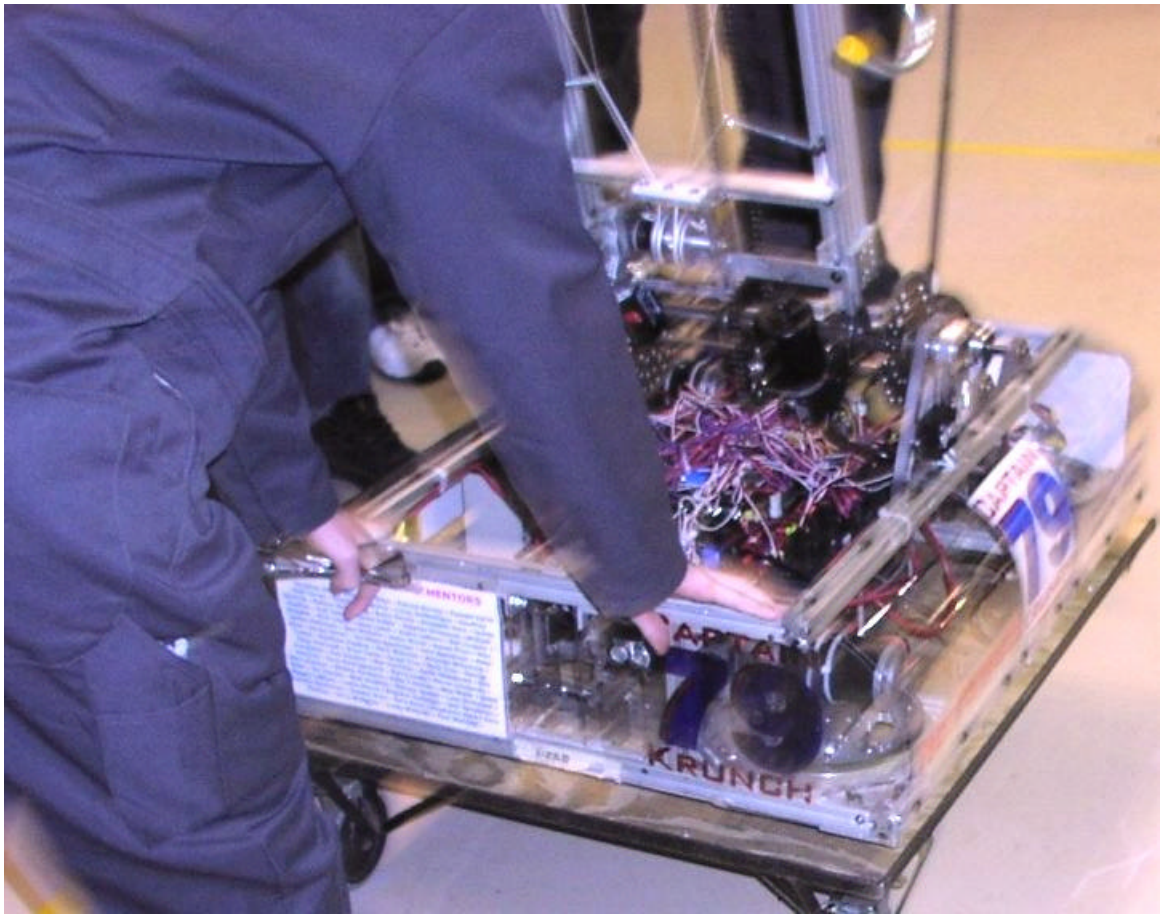
Team-79

The Navigators



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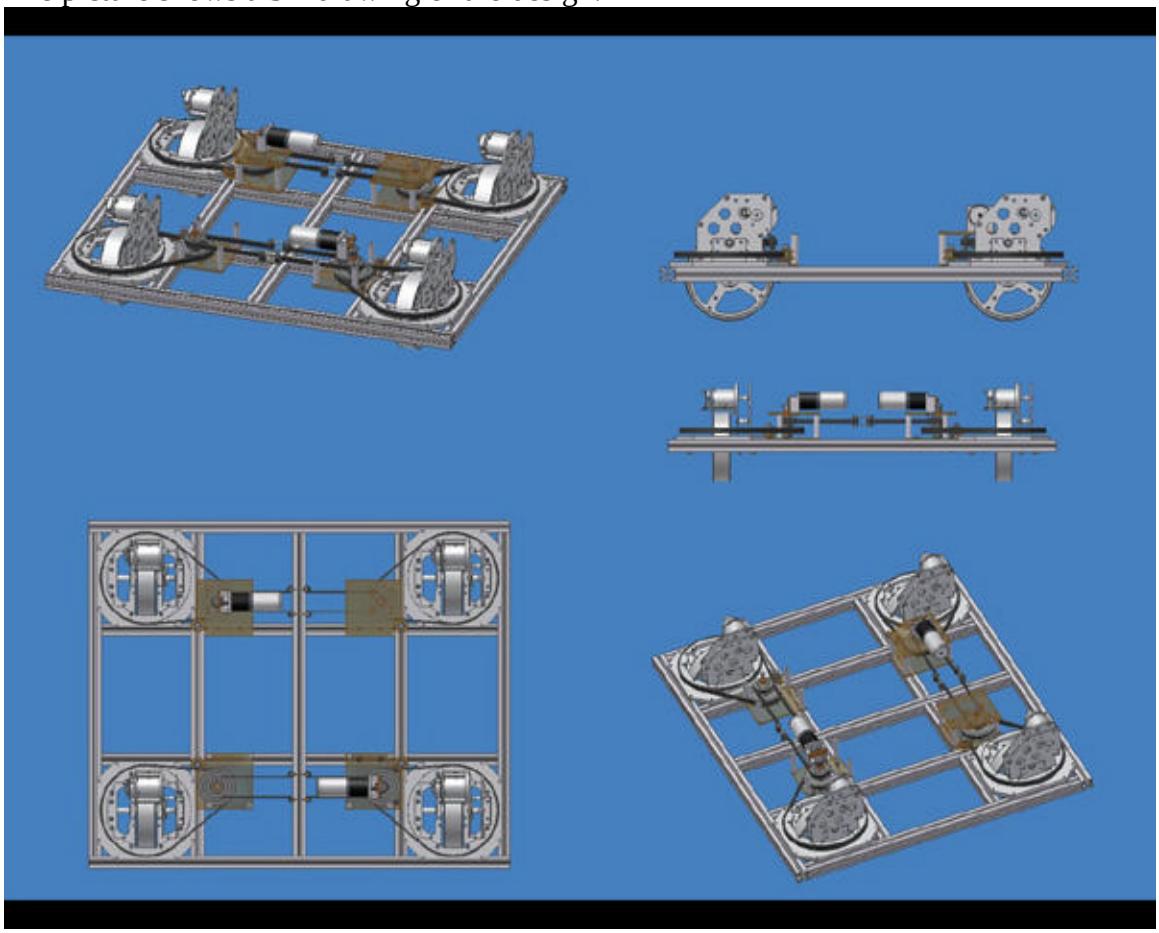
Introduction

This is a document concerning robot steering.

In order for a team to select the right drivetrain for the desired task, one must know the capabilities of each drivetrain type. Once this knowledge is attained, the situation can be analyzed and the correct drivetrain chosen. This document explains the numerous steering modes for Team 79's robot, Captain Krunch 6. It uses a crab-drive design.

The picture shows a 3D drawing of the design.



Crab Steer

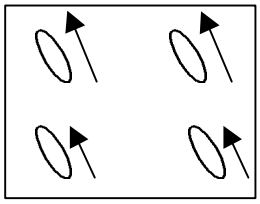
This driving mode was new to the Team 79 arsenal, first used in 2003 for the Stack Attack game. The name comes from the way the robot can move sideways without turning, in a scuttling, crab-like motion. Therefore, it was named "crab drive". All four wheels turn together, allowing quick left or right movements to avoid obstacles while the wheels continue traveling forward. Thus, it does not lose much, if any speed. This rolling speed is determined by how far the operator moves the joystick in the desired direction. However, if an operator were to move from forward to reverse along the y-axis, a 180° turn of the wheels would not take place immediately, since the wheels will

only switch from forward to reverse after a simple 90° turn. However, in this case, a threshold is soon reached, and the wheels will turn to the desired reverse direction.

Two-Stick Crab Steer

In this mode, one joystick (primary) provides steering angles while the other (secondary) provides the power. In the diagram, the arrows show the rolling direction of the wheels.

Crab steer →



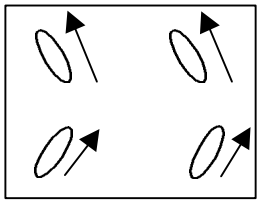
Tank Steer

This is a basic method of steering for nearly every robot in competition. The wheels are aligned with each other, front to back. Each side of the robot, both front and back wheels, are powered separately. To turn, one side of the robot is powered forward, and the other side powered reverse, causing a turn around the center of the robot. When turning, one should avoid moving the joystick in a diagonal direction. For a turn of 45° would produce only slightly more power on one side than on the other. Not enough wheel slippage would occur to allow for a nice turn. Therefore, the best way to turn is to move the joystick along the x-axis. The way to achieve optimum forward or backward drive is to move the joystick along the y-axis.

Car Steer

A rather odd looking method of steering, the front and rear steering are both moved in opposite directions. Rolling power is often the same on all four wheels, where the speed of the rolling is determined by the Y position of the joystick. When the front wheels are at an angle based on the X position of the joystick (typically limited to 22 degrees), the robot turns. The angle limitation is to allow the wheels to slip on the floor without too much effort. In this driving mode, the rear steering is a mirror image of the front, so the turning rate is much greater than with a single-axle turn.

Car steer →



Simple Steer

This mode allows only the front axle to steer. The rear axle is at a constant zero to the center. Like the car steer, rolling power is usually equally distributed among all four wheels, and speed determined by the Y position of the joystick. However, during a turn, the outside wheels could be given more power, increasing drive on the outside and decreasing drive on the inside, yielding a tighter turn radius. As with car-steer, the turning occurs when the front wheels are at an angle based on the X position of the

joystick, with the same 22-degree limitation. This yields a small turning rate, the turning diameter producing a large circle.

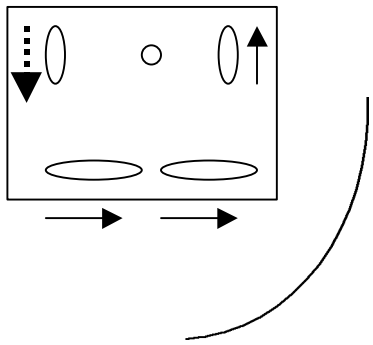
Wheel Lock

Created for the 2003 game "Stack Attack", this mode is activated by a toggle switch on a control box. The wheels are turned to right angles of each other when the lock is on. Because the front wheels both face the same direction, this is not a perfect lock; but with the location of the wheels (front angled 45 degrees left of center and rear angled 45 degrees right of center), the robot creates maximum "static friction" with the floor. This disposition renders the robot difficult to move with almost any horizontal force another robot could exert on it.

Power Caster (Front)

This mode gets its name from the wheel positions. The steering in front is set straight ahead, and the rear is set turned to the right by 90°. It looks like a two-wheel pivot about the front, while the rear appears like castering wheels. However, unlike a simple castor, all four wheels have rolling power. When the joystick is moved to the right along the X-axis, the robot rotates clockwise about the center of the front. The left-front wheel is the only one driven in the opposite direction of the stick.

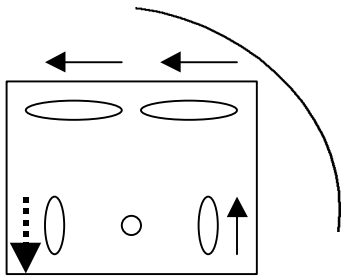
Power caster (front) →



Power Caster (Rear)

The steering in the rear is set straight ahead, and the front is set turned to the left by 90°. When the stick position decreases toward the right, the front wheels move in reverse, causing a clockwise rotation. The robot is now rotating at a point in the rear of the robot. The rear-left wheel is the inverted one in this power caster mode.

Power caster (rear) →



Anti-Turbo

Although not a technical “steering mode”, this will reduce wheel power to 25% of normal, so it essentially does affect steering, and so we list it here. This can be used with all driving modes.

Conclusion

We developed these steering modes in 2003 and 2004. Although all these steering modes exist on Krunch 6, not all of them were used. They could have been activated at the driver station. However, the drivers chose only those that worked best on the field. The others are simply there, waiting on the sidelines, should there be objectives to accomplish where they are more suitable.

Contacts

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