Steering Mechanisms

# Background -

The current steering and suspension systems used in rovers are designed for relatively low speed operations as signals cannot be sent and processed fast enough. The system used currently in rovers by NASA employs the 4-wheel Ackerman type steered turn .

There can be multiple steering systems ,most obvious is skid steering (tank style).

The problem with this system mainly is -

* The rate of turn for a certain number of wheel revolutions is highly dependent on the characteristics of the surface you're on. That is, you can't command the rover to turn the wheels for x number of seconds or revolutions and know where you're going to end up with enough precision.

# Current Solution -

* The accepted best way of performing a traverse (going from point A to point B) entails traveling in straight lines connected with turns in place to correct heading.
* The rovers do not travel and turn at the same time. This could be done, but would require an exponential increase in the complexity of the control algorithms and wouldn't really be worth the effort and risk.

The method of steering that seems to be the best compromise is an Ackerman-type, 4-wheel-steered turn in place. Ackerman steering geometry means that the center of the turn radius of each wheel is in the same place. For the rover, the four corner wheels turn. The wheels at the front corners toe in and those at the rear corners rotate the opposite way, such that the center of the turn radius of each wheel is at the same place as the others. The center wheels do not turn, but due to their location they do not appreciably detract from steering performance.

The question here lies in the method of actually turning the wheels

* . Mass is always a huge issue in the design of flight hardware. In addition, mass and its location has a large effect on the mobility of the vehicle.
* Any mass devoted to steering hardware is located at each wheel, in the critical "unsuspended" areas. The drive and steering actuators (motor/gearbox combinations) are located within or near each wheel.

The main idea is to try to design the steering geometry to eliminate the steering actuators altogether.

The current curiosity rover uses steering swivel motors that can turn the robot by aligning the front 2 wheels and the back 2 wheels by particular angles.This is a slow yet efficient method of turning the rover.

# Improvements-

The next possible improvement over this is the introduction of a crab-like movement system , which provides even greater maneuverability , but complicates the control algorithms.(European ExoMars 2020 rover) .

# Sources -

* <https://www.rs-online.com/designspark/give-your-robot-the-mobility-control-of-a-real-mars-rover-part-4>
* <https://www.cefns.nau.edu/capstone/projects/ME/2000/buggy/Rover.html>