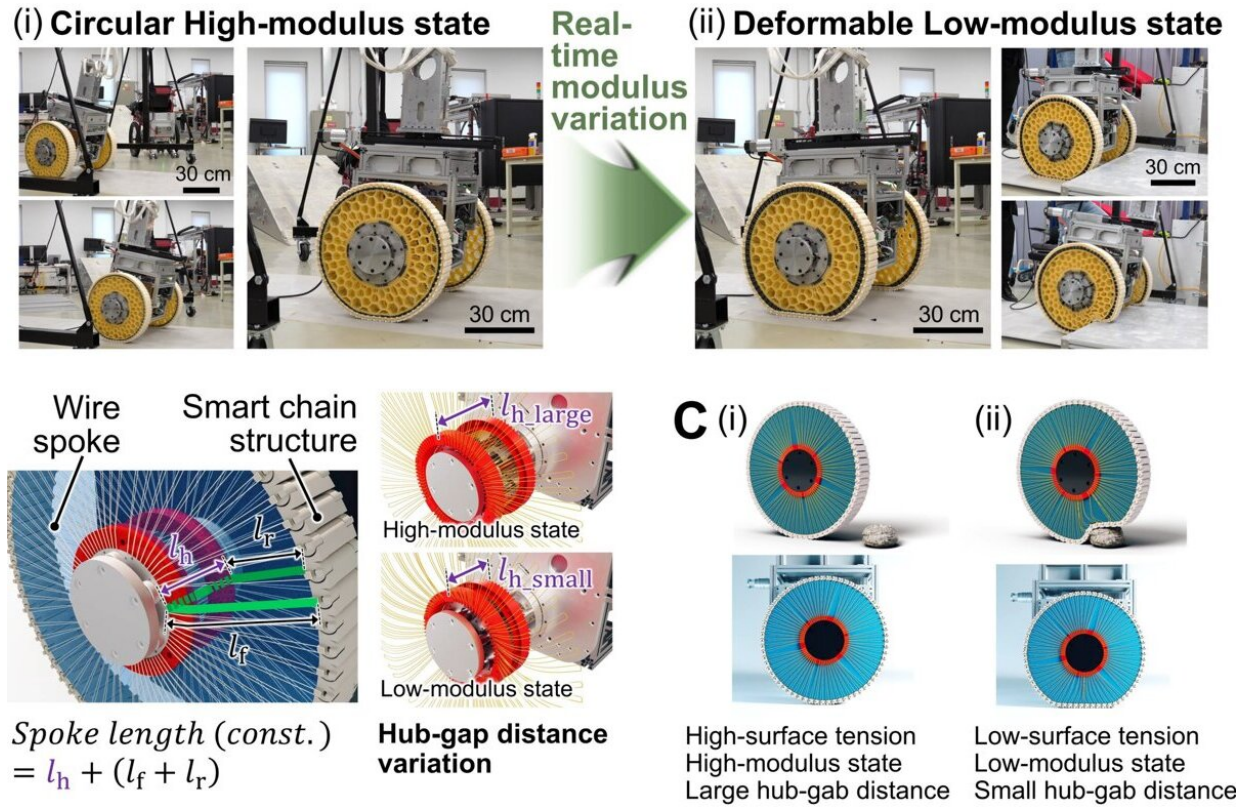
Watch how this shape-shifting wheel tackles uneven surfaces

August 15 2024, by Bob Yirka



Configuration of the variable-stiffness morphing wheel. Credit: Sung-Hyuk Song, Korea Institute of Machinery and Materials

A team of engineers from several institutions in South Korea has developed a type of wheel with spokes that can be adjusted in real time

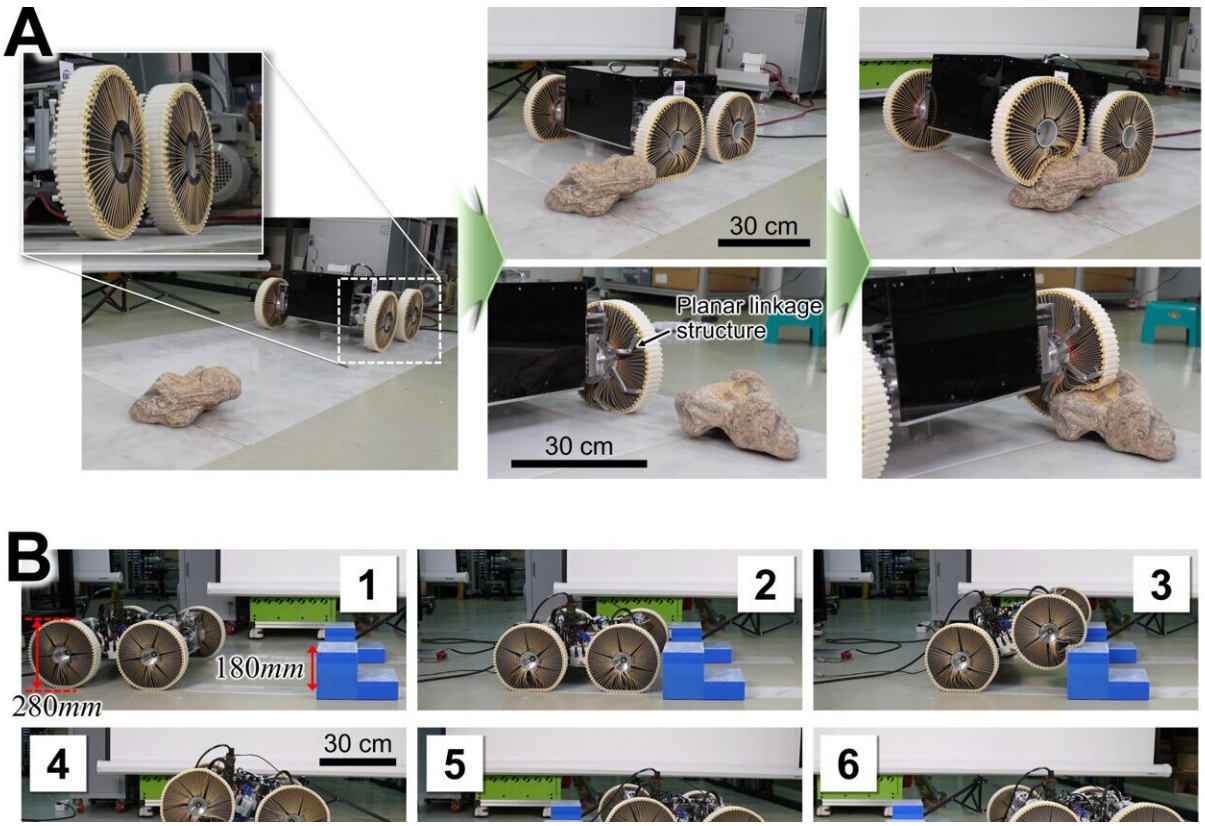
to conform the wheel's shape to uneven terrain. In their paper published in the journal *Science Robotics*, the group describes the principles behind their wheel design and how well it worked in two- and four-wheeled test models.

Round wheels are not ideal for traveling over uneven terrain, including rocky outcrops and stairs. The reason they work so poorly is they do not conform to the encountered terrain. In this new effort, the research team created a wheel design that does conform and is much better at traveling over surfaces that are not flat.

The researchers placed a chain of rectangular blocks around the perimeter of the wheel to serve as the tread. Each of the blocks was then connected to wire spokes, the other ends of which met at an adjustable axle hub. The hub was designed with adjustable gaps between its two sides, which allowed the modification of the wire spoke lengths. That enabled the block chain to transform. The result is a wheel with a changeable shape.

The research team showed that an increase in gap distance results in shorter spokes, which pulls a portion of the block chain (tread) inward, changing its shape to match that of the terrain. The wheel can also assume a rigid, round shape when traveling on flat terrain.

To demonstrate the utility of their design, the research team built a four-wheeled vehicle and pulled it over a variety of different obstacles. The wheel conformed as designed, making travel over obstacles much easier than with a nonconforming wheel. The team also built a two-wheeled vehicle to show that it could be used to build wheelchairs for use in many more places than current designs allow.



Evaluation of wheel characteristics based on the surface tension. Credit: Sung-Hyuk Song, Korea Institute of Machinery and Materials

The team suggests their design would likely be useful for rolling robots and off-road vehicles, reducing the limitations of traditional wheel designs.

More information: Jae-Young Lee et al, Variable-stiffness–morphing wheel inspired by the surface tension of a liquid droplet, *Science Robotics* (2024). DOI: 10.1126/scirobotics.adl2067