

Structural Analysis of Mecanum Wheel for Mobile Robot Design

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This study deals with an omni-directional mobile robot based on Mecanum wheel. A unique geometric property of the wheel provides the mobile robot with omni-directionality without nonholonomic constraints, so that the mobile robot can move to any directions without a rotation of the body or an additional space. The Mecanum wheel is composed of several sub-rollers which are mounted around the rim wheel at a specific angle to the wheel axis. Since the geometric configuration of the Mecanum wheel is relatively complicated than convention wheels, the structural analysis prior to wheel manufacturing is mandatory. In this research, 3D modeling of the Mecanum wheel was performed. Based on the 3D model, the maximum stress and deformation caused by gravitational effect of the mobile robot platform were calculated. Finally, considering material properties of the wheel elements, it is confirmed that the calculated figures are under allowable limits.

Keywords: Omni-directional mobile robot, Mecanum wheel, Structural analysis, 3D modeling, Stress, Deformation