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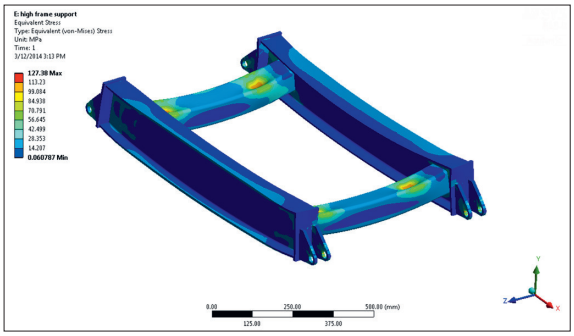
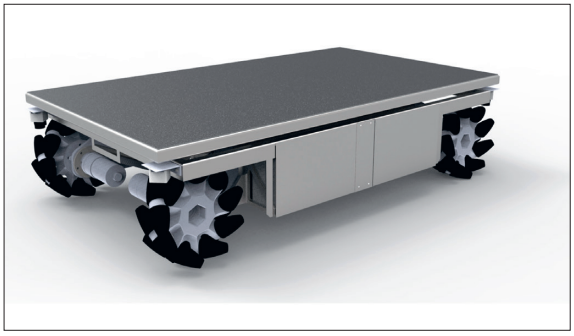
Design of a Holonomic Dexterous Heavy-Duty Platform

Based on Mecanum Wheels

MAVEN overview (Mobile Avatar for Virtual Engagement)



FE analysis of the main structure



Mobile holonomic lifting platform

Introduction: The laboratory of advanced robotics at NTU is involved in a series of projects concerning advanced robot telepresence. The goal is to improve the experience of telepresence robots though the use of an automated mannequin. This mannequin conveys gestures and thus helps to improve communication. To make the mannequin mobile it is mounted on an autonomous dexterous mecanum platform. The mecanum wheels are a specific type of wheels that allow a platform utilising these wheels to move freely. The use of such a platform allows the mannequin to mimic the kinesic behaviour of a human.

Objective: The goal of the project is to develop and ultimately build an autonomous holonomic heavy-duty platform. The holonomic movement is achieved by utilising mecanum wheels. The platform shall be used in an industrial environment, such as an assembly hall or a logistics building. A holonomic platform uses less space to manoeuvre, and thus, unusable space can be saved. This in turn results in smaller buildings or greater productivity. My specific task in this project is to design the main structure and mechanisms of the platform, as well as to define the main electrical components, such as driving motors and linear actors. The software part and the implementation of the sensors can be largely transferred from the platforms already existing.

Solution: The concept developed consists of a purely electrical drive system and a close looped electro-hydraulic lifting system. The motors are mounted in a direct linear way to the wheels.The main structure is a welded steel construction consisting mainly of I-beams and hollow square beams. Steel has been prefered to aluminium, mainly because of its superior properties against corrosion in salty environments. The feasibility of the design is verified by applying finite element-analysis and motion-analysis. Special attention has been given to the suspension system. It consists of a kinematic chain mechanism, which is able to correct undulation in the floor, and thus ensures contact between the wheels and the ground. This is a crucial part of the overall system, since the manoeuvrability is lost if not all four wheels are in contact with the ground at all times.