

#### LARM2: Laboratory of Robot e Mechatronics www.larmlaboratorynet Simulations and lab experiences on head impact

Date: January 2020

Authored by: José Luis Rueda Arreguín PhD student enrolled in a double degree program with Instituto Politécnico Nacional, México.



Lab Director: Prof. Marco Ceccarelli

## Background

Work plan:

Mechanism design

Characterization

**Experimental test** 

**Simulations** 

**Problems:** 

- High frequency
- Limited Study







Fig 1. Events with high frequency of head impacts.

# Performance and simulations





## Design Proposal and Modeling





Fig 2. A design of a PK solution for head impact simulation: a) a kinematic Scheme; b) a CAD solution.



Fig 3. Experimental layout at LARM2 in Rome: a) a scheme; b) a lab solution.

Fig 4. A snapshot of simulated operation in testing head impact



Fig 5. Simulation results in terms of: a) force on the head; b) actuator forces.

# Results





Fig.6. Experimental layout results for testing lateral impact in terms of: a) impact force by sensor 1; b) accelerations by IMU sensors.

### Reference

1.- Rueda Arreguin J.L., Torres San Miguel, C. R., Ceccarelli, M., et. al., Design of a Test Bench to Simulate Cranial Sudden Impact, In Carbone, G., Ceccarelli, M., Pisla, D. (eds.) New Trends in Medical and Service Robotics, (65), pp. 225-234, Springer, Cham (2019).