Designing An Articulating Arm With High Speed Releasing Mechanism For An Impact Test Rig

Status: Available

Group Members: TBD

Sponsor(s):

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Project Description

Here at Head Injury Prevention Lab (SFU Surrey), Dr. Iman Ebrahimi (Postdoc) under supervision of Dr. Farid Golnaraghi has developed a novel test rig for executing oblique impact on helmets. Why performing oblique impact is important? Because helmets almost always strike an obstacle obliquely, causing both linear and rotational acceleration of the head. Yet the majority of the helmets are designed to protect the wearer only against linear acceleration. In general, an impact exerts two types of force to the head, radial (normal) and tangential. Radial force generates linear acceleration and tangential force generates rotational acceleration. While there are several kinematic head injury assessment functions, maximum linear acceleration (radial impact) was and is still used in helmet standards. It is known that linear acceleration/deceleration of the brain causes bruising and compression. However, studies have also found that rotational motions (velocity and acceleration) are another major source of head injuries. Rotational acceleration of the head is produced mainly by tangential force or impact, and it causes sheer stress that can result in bleeding or displacement of the brain inside the skull. The test rig consists of a linear guide, a slider, and an arm and can reach 8m/s speed. The current arm has limited adjustability, which makes it inconvenient to adjust it for all types of helmets. In this capstone project we expect the participants to redesign the arm based on the given requirements. Also, the current design uses a mechanical auto-release system, and we would like to replace it with a high speed actuator. The new design will be evaluated by Dr. Golnaraghi and Dr. Ebrahimi, and if approved it will be built and installed on the test rig.