

AUXETIC WEAR

DAYANA BRAHEM • NIKOLINO BREGU • SIVADARSHAN GANESAN • MUHAMMAD ANWAR



PROBLEM STATEMENT

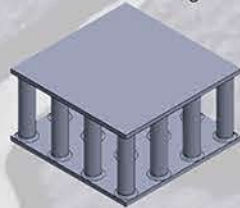
The main problem to be solved is to reduce the risk of concussions for many contact sports. This damage is caused when the head experiences a sudden impact load and initiates a rapid head velocity. The brain remains stationary due to inertia and will have contact with the interior skull cavity. This causes apparent physical brain damage that can have adverse effects and long term neurological problems.

OBJECTIVE

The basic design objective is to create a helmet protection layer that incorporates the concept of auxetic geometry and take advantage of its mechanical properties to reduce impulse loads and resulting momentum velocity.

DESIGN SOLUTIONS

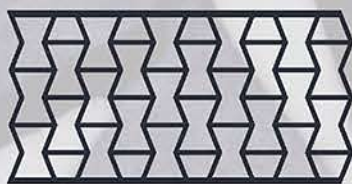
Observing the market standard for this application, the design geometry of the VICIS ZERO1, (as shown below), was used as a comparator for AUXETIC WEAR. This helmet was rated the best for concussion prevention by the NFL for the years 2017 and 2018.



The Arrowhead: A possible auxetic geometry aimed to perform better than the VICIS design.

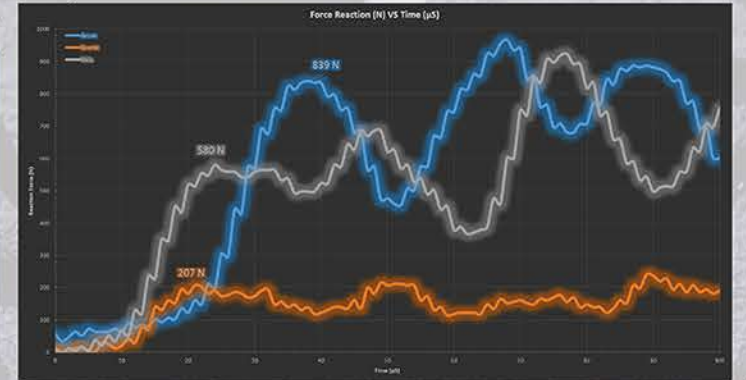
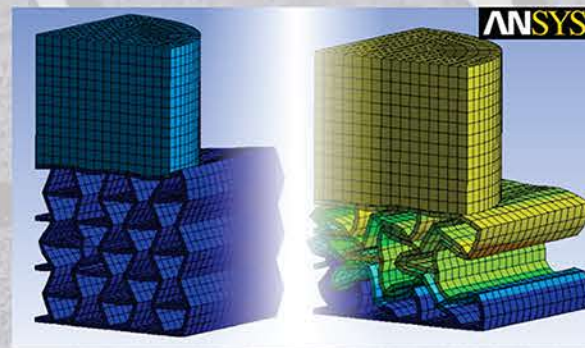


The Bow-Tie: Also referred to as an inverted hexagon. Another possible auxetic geometry aimed to surpass the performance of the VICIS geometry.



RESULTS

- In order to test the performance of AUXETIC WEAR designs to that of VICIS, a section of the protection layer geometry was designed and tested through CAD simulations, both statically and dynamically.
- All CAD models were physically manufactured through rapid prototyping, so as to test the geometries in a real world environment through a drop test (with similar conditions to the dynamic simulations, as shown below).
- Final results concluded, the Bowtie auxetic design performed the best for impulse load reduction (as shown in figure below).



FUTURE WORK

The objective of AUXETIC WEAR was accomplished, which was to design an effective protection layer using auxetic geometry, ultimately for helmet application to prevent concussions.

As the initial research and design solution objective is complete, the future of this project will be to manufacture a full helmet, (as shown below), and test the performance in a more relevant application.

The final form of the project will be to manufacture the helmet on a large scale for full market penetration.

