

The Multisport Cleat

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Abstract

The goal of this project was to design a children's cleat that can be effectively used in soccer, baseball/softball, and football. To achieve this, two different cleats were designed. The first design is the Universal Cleat that can be used in each of the sports listed as it utilizes all fixed studs and requires no modifications. The second design is the Detachable Stud Cleat with removable studs, which can be customized to better optimize the performance capabilities of the athlete when playing a specific sport. Both cleats were designed to be 3D printed using thermoplastic polyurethane.

Introduction

Currently, cleats are designed for one specific use. Our project is intended to make it more affordable for families by offering a less expensive alternative to buying multiple pairs of cleats. Our cleat designs must be able to withstand the force of the changing of direction from the players. The materials used must be strong enough to prohibit the breaking of the shoe upon maximum loading, which could result in injury. The guidelines vary for each sport, so we used rulebooks from each sport and designed a shoe that is viable and does not break any of the rules. Because youth sports do not have any specific rules for detachable cleats, upper level rulebooks were used.

By researching current youth cleats we found a family would spend roughly \$138 for their child to play all three of these sports. The Universal Cleat would most likely be sold at a similar price to current cleats at around \$45, allowing families to save about \$93. For the Detachable Stud design, the cost will be higher as it will include a more difficult manufacturing process. Using an estimate of \$90, a family would still save \$48 per pair of cleats.



Adidas World Cup and Nike Magista Cleats Referenced for Design and Cost

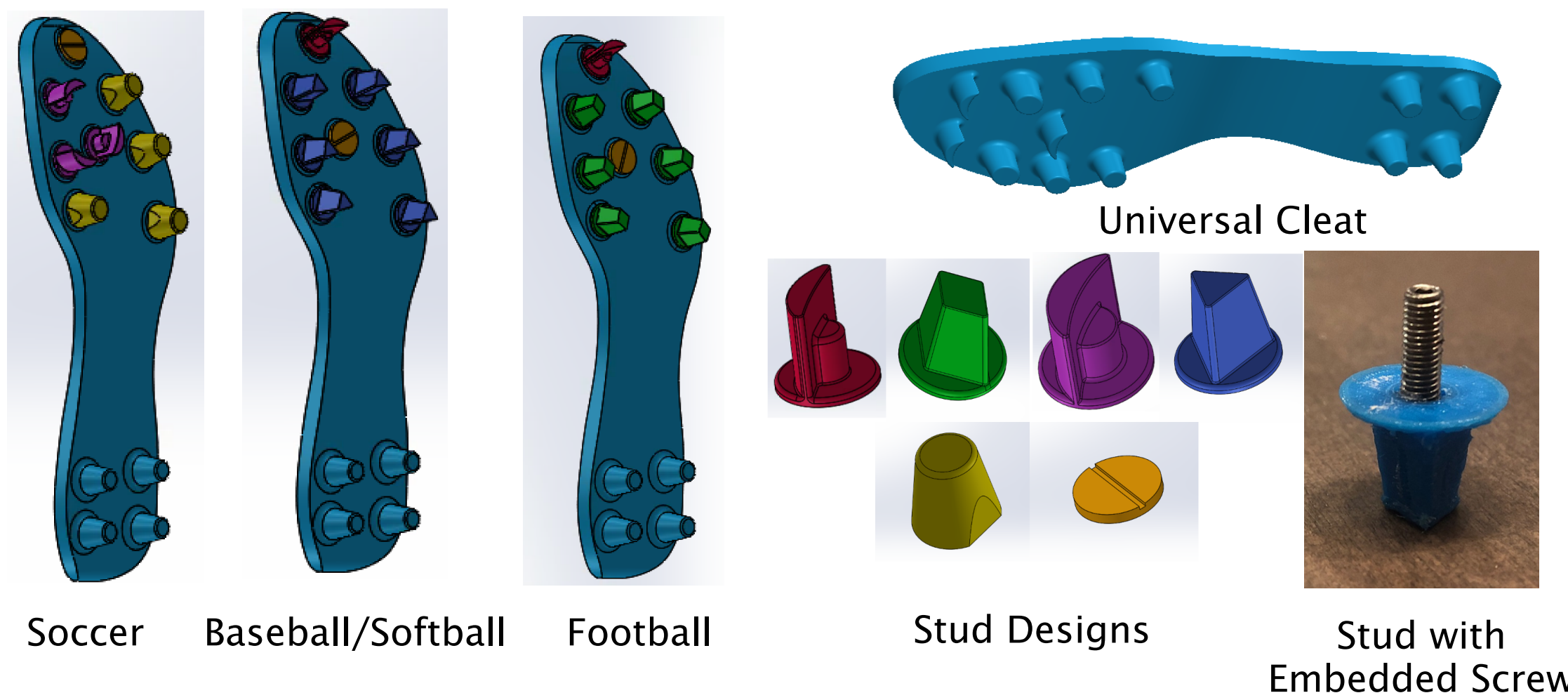
Methods | Design | Analysis

The Universal Cleat

The first design we created is what we call the Universal Cleat. This cleat uses all fixed studs in a way that makes it legal to use in all of the targeted sports.

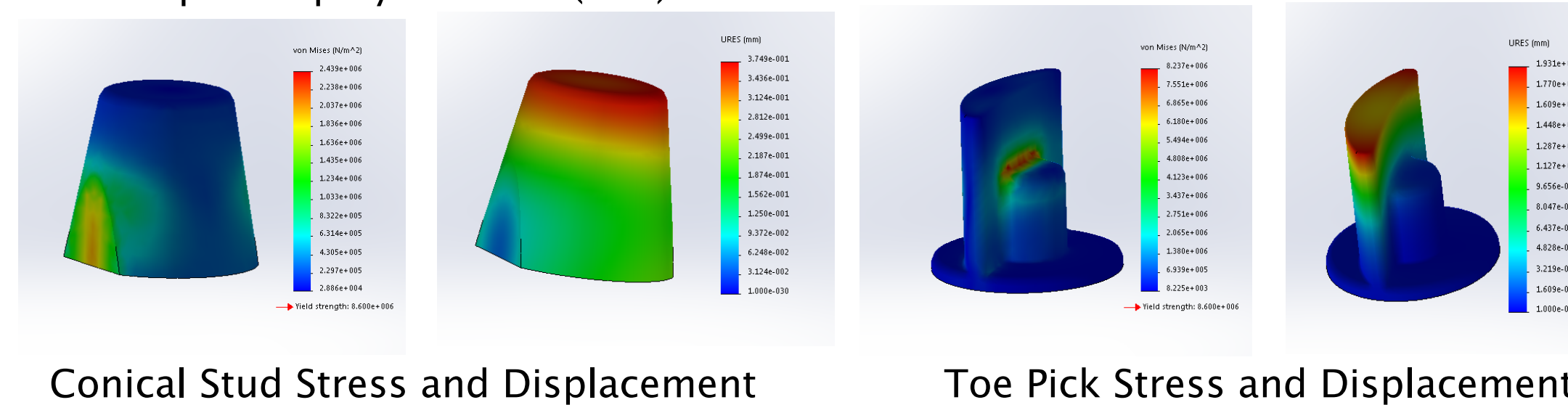
The Detachable Stud Cleat

The second design we created is the Detachable Stud Cleat. There are three variations of this cleat for each of the sports we focused on. This design utilizes a combination of removable studs, fixed studs, and a locking mechanism. Because different sports demand different technical skills, the detachable stud cleat is made specifically to cater to the footwork required and aid the player's efficiency in completing those skills in each of the targeted sports.



Results

Finite Element Analysis was performed on each stud to ensure that it could withstand the maximum force that a player could apply to each individual stud. The maximum stress needed to be less than the yield strength of the material, thermoplastic polyurethane (TPU).



Conclusion

In the end, it was found that the cost to create the sole of the Universal Cleat is \$7.50, and the cost to create the Detachable Stud Cleat, which includes the outsole, locking mechanisms, and all studs, is \$22.84. The Detachable Stud Cleat design provides more advantages in technical ability due to its potential to change between sports to better cater to the skills needed, while the Universal Cleats must be a compromise between the sports. However, because no testing was completed, we are unable to conclude which design is the most effective multisport cleat.



Detachable Cleat Prototype with Various Studs

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References

Alvarez, Edgar. "Nike's Latest Soccer Cleat Is Its Most Data-Driven Shoe Yet." Engadget, 1 Aug. 2016.

Ewald M. Hennig & Thorsten Sterzing (2010) The influence of soccer shoe design on playing performance: a series of biomechanical studies, Footwear Science, 2:1, 3-11.

"Technical Data Sheet: TPU 95A." Ultimaker, Nov 19, 2018.

