Braided Composite Music Stand

Elizabeth Pawliuk, Eric Lepp, Evans Frandsen, Kate Bennett, Alvaro Arce-Borkent, Jason Carey

Department of Mechanical Engineering, University of Alberta

Introduction

- Composites are two or more materials that are combined and tailored to fit a specific purpose
- They are strong, durable, and lightweight which are all benefits in engineering for construction [1]
- Music stands are typically made out of hard plastic or metal
- Music stands do not typically last for long periods of time due to heavy use and cheap materials [2]

Figure 1. Example of braided composite

Figure 2. Example of plastic music stand [3]

Objective

The objective of this project is to improve the efficiency of music stands using braided composite

Methods

- The forces acting on the music stand were determined (Figure 3)
- The head, stalk, base, and legs were designed on SOLIDWORKS®
- The music stand would need 10 braids and seven connecting pieces to put it all together
- The base and connector parts were sent to the ELKO Garage to be 3D printed
- The materials used were chosen based on durability and flexibility

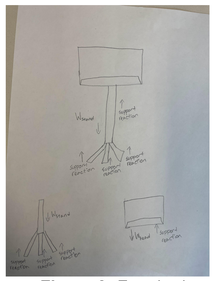

Figure 3: Free body diagram of music stand

Table 1.

Part of music stand	Braid material	Matrix	Braid angle	Resin to hardware ratio
Legs	Kevlar®	EcoPoxy	35°	60% fiber 40% matrix
Stalk	Kevlar®	EcoPoxy	35°	60% fiber 40% matrix
Head outline	Kevlar®	EcoPoxy	35°	60% fiber 40% matrix

Construction

The Kevlar® is wrapped around the braid machine and is looped through the center and taped to the mandrel

The braid angle is set to 35° and the machine is started

After the braiding machine is finished the braids are moved off of the mandrel and are put on the curing mandrel

It is then coated with an EcoPoxy resin and hardener and is then left to cure overnight

The cured braids are attached in the shape of a music stand using the seven 3D printed connector pieces.

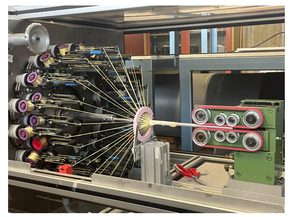

Figure 4: The braid machine ready for braiding with the Kevlar® put through the centre ring and taped to the mandrel

Figure 5: SOLIDWORKS® model of music stand base

Figure 6: 3D printed music stand base

Conclusion

- Building a music stand out of braided tubular composites increases its durability, strength, makes it more lightweight, and makes the music stand longer lasting.
- By making music stands more durable it would prevent having to replace them frequently and would make it more financially feasible.
- To use braided composites to make music stands there would need to be a factory or bigger machine that could make multiple braids at once as multiple braids need to be used and it takes quite a while to make them.

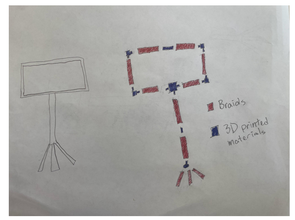

Figure 7: Sketch of music stand with exploded sketch of music stand showing braids and 3D printed parts

Acknowledgments

- Thank you to my supervisors Eric, Evans, Kate, and Alvaro, my Principal Investigator Jason Carey, and to the entire Carey Lab
- Thank you to my sponsors Canada Summer Jobs, Process Solutions, and Carey Lab
- Thank you to the Women In Scholarship, Engineering, Science, and Technology (WISEST) for this opportunity and your support
- Thank you to my lab partner Sienna Gin for all your help throughout this program

References

[1] K. Karthik, D. Rajamani, T. Raja, K. Subramani, “Experimental investigation on the mechanical properties of Carbon/Kevlar fibre reinforced epoxy LY556 composites,” *Materials Today: Proceedings*, vol. 52, part 3, pp. 668-674, 2022, doi: https://doi.org/10.1016/j.matpr.2021.10.077

[2]“What Is a Music Stand? - Spiegato,” Jun. 07, 2021. https://spiegato.com/en/what-is-a-music-stand (accessed Aug. 09, 2023).

[3] “Manhassett Symphony Music Stand, Plastic Desk,” *www.musiciansupply.com*. https://www.musiciansupply.com/shop/c/p/Manhassett-Symphony-Music-Stand-Plastic-Desk-x50175250.htm (accessed Aug. 10, 2023).