

AFOOT: Ankle Foot Orthotics Testing Jig

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BACKGROUND

- Ankle Foot Orthotics (AFOs) control position and motion, compensate for weakness, and correct ankle deformities
- Used for conditions including Cerebral Palsy and Stroke
- 3 AFO Types: Rigid, Articulating, Energy Storage and Return
- AFOOT is designed for Boundless Biomechanical Bracing Inc
- Pre-existing testing methods are restricted to research laboratories, which use force plates and orthotics held in static position [1]

MOTIVATION

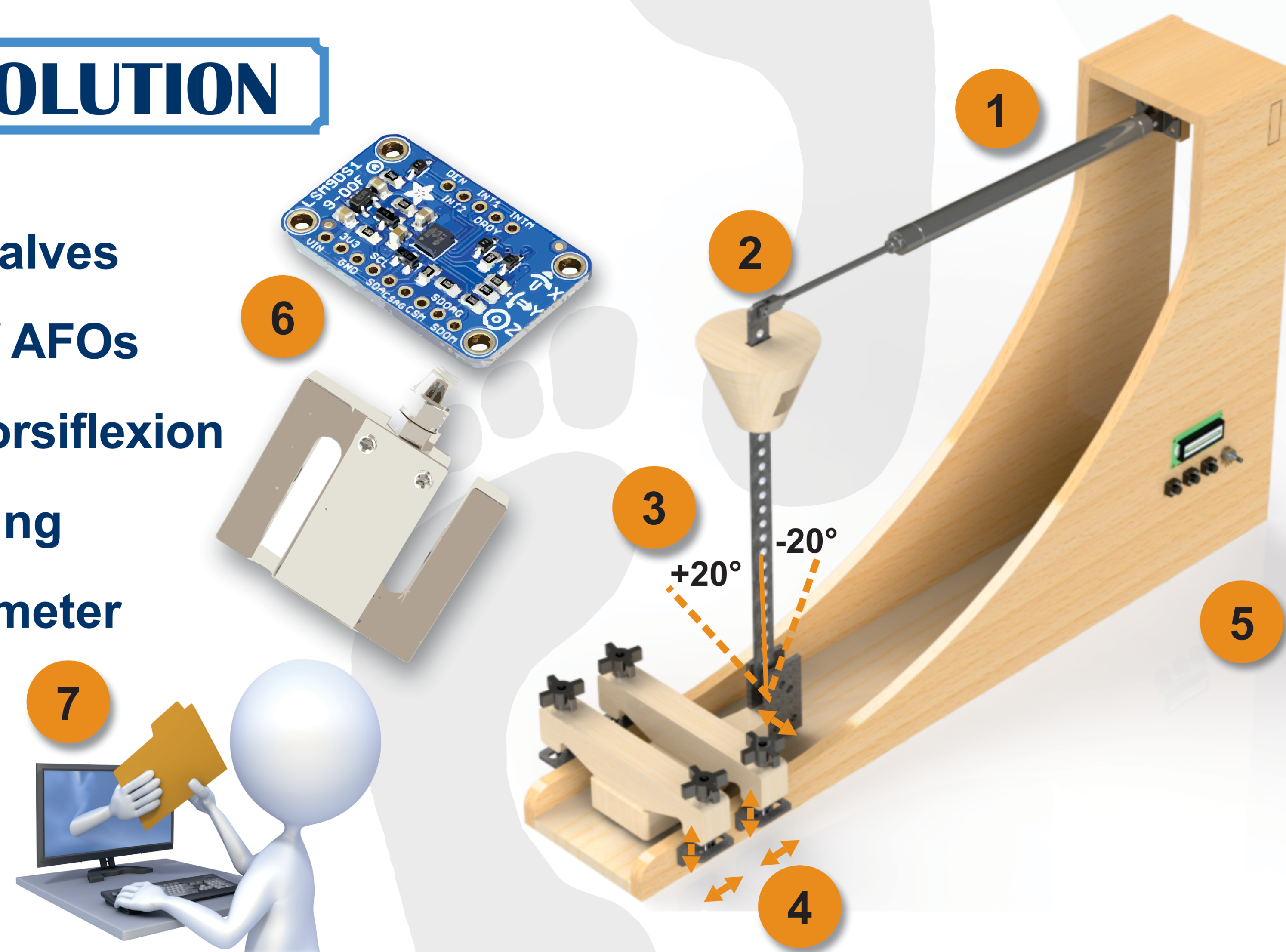
- Lack of automated and commercial testing equipment
- Manual testing is time-consuming and expensive
- Market demand to compare effectiveness of various AFOs

OBJECTIVES

- Develop an automated, adjustable testing jig for different sizes, materials, and types of AFOs
- Simulate a human gait cycle through dynamic testing
- Simplify user experience for clinical settings

DESIGN SOLUTION

1. Pneumatic Air Cylinder with Directional and Proportional Valves
2. Adjustable Bar and Cone-Shape Insert for Different Sizes of AFOs
3. Simulates Real-Life Gait Cycle of $\pm 20^\circ$ Plantarflexion and Dorsiflexion
4. Adjustable Clamp System for Stabilizing AFOs during Testing
5. Intuitive User-Interface with Screen, Buttons, and Potentiometer
6. Real-Time Raw Data from Force and Angle Sensors
7. Data Export to Computer for Further Analysis



DESIGN VALIDATION AND BENEFITS

BENEFITS

- Improves quality control of AFOs
- Provides quantitative results for analyzing AFO effectiveness
- Faster diagnosis of AFO issues through testing
- Components of AFOOT are biodegradable or recyclable
- Contributes to academic research
- Portable and easily transported



Figure 1: Finite Element Analysis (FEA)

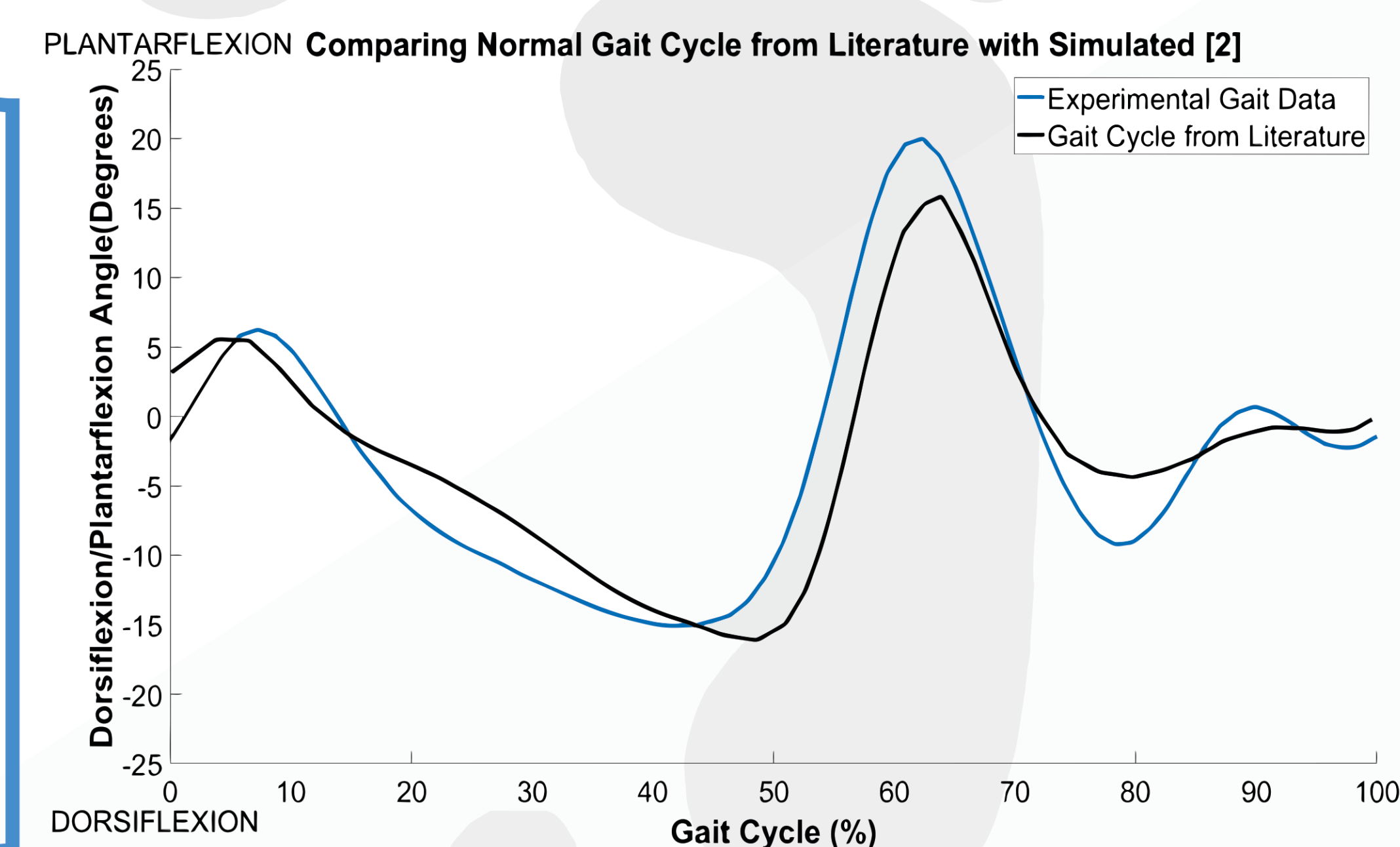


Figure 2: Comparison of Literature and Experimental Gait Cycle

MARKETABILITY AND NEXT STEPS

- Total cost of AFOOT: CAD \$1,700
- Mass production to lower costs
- Distribution to other Prosthetics and Orthotics Clinics
- Further development to allow testing of other orthotics and foot insoles

CONCLUSIONS

- AFOOT simulates a human gait cycle repeatedly
- Successfully collects real-time angle and force data
- Exports data to a computer for analysis
- Automates dynamic testing for orthotics
- Practical, functional, and portable in clinical settings

References:

- [1] D. Bregman, V.de Groot, A. Rozumalski, D. Kooops, M. Schwartz and J. Harlaar, "A new method for evaluating ankle foot orthosis stiffness: BRUCE," Gait & Posture, vol. 28, no. 2, pp. 144-149, 2009.
- [2] T. Tsatalas, G. Giakas, G. Spyropoulos, V. Paschalis, M. Nikolaidis, D. E. Tsaopoulos, A. A. Theodorou, A. Z. Jamurtas and Y. Koutedakis, "The effects of muscle damage on walking biomechanics are speed-dependent," European Journal of Applied Physiology, vol. 110, no. 5, pp. 977-988, 2010.

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