



## **Introducing a Test Setup to Measure the Tribological Behavior of Shoe-Surface Interactions under Biomechanically Relevant Conditions**

**Jakobsen, Lasse; Lysdal, Filip G.; Jensen, Rasmus K.; Kersting, Uwe G.; Sivebæk, Ion M.**

*Publication date:*  
2021

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*

Jakobsen, L., Lysdal, F. G., Jensen, R. K., Kersting, U. G., & Sivebæk, I. M. (2021). *Introducing a Test Setup to Measure the Tribological Behavior of Shoe-Surface Interactions under Biomechanically Relevant Conditions*. Poster session presented at The 24th Annual Applied Ergonomics Conference 2021.

---

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.



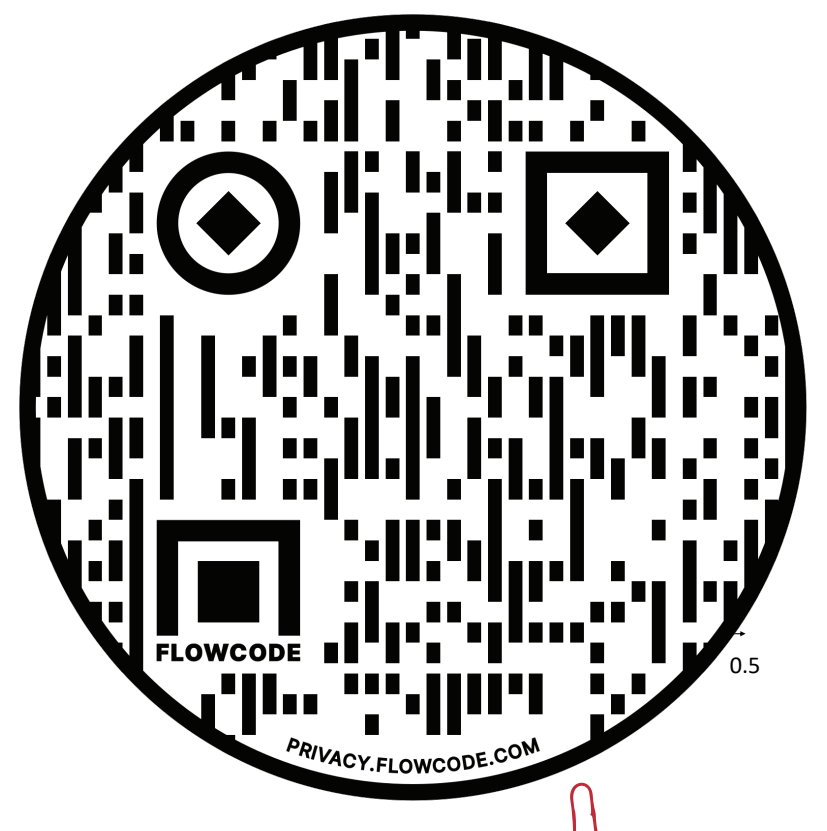
# Introducing a Test Setup to Measure the Tribological Behavior of Shoe-Surface Interactions under Biomechanically Relevant Conditions

Lasse Jakobsen<sup>1\*</sup>, Filip G. Lysdal<sup>2</sup>, Rasmus K. Jensen<sup>2</sup>, Uwe G. Kersting<sup>2</sup> and Ion M. Sivebæk<sup>1</sup>

<sup>1</sup>Department of Mechanical Engineering, Technical University of Denmark, Denmark

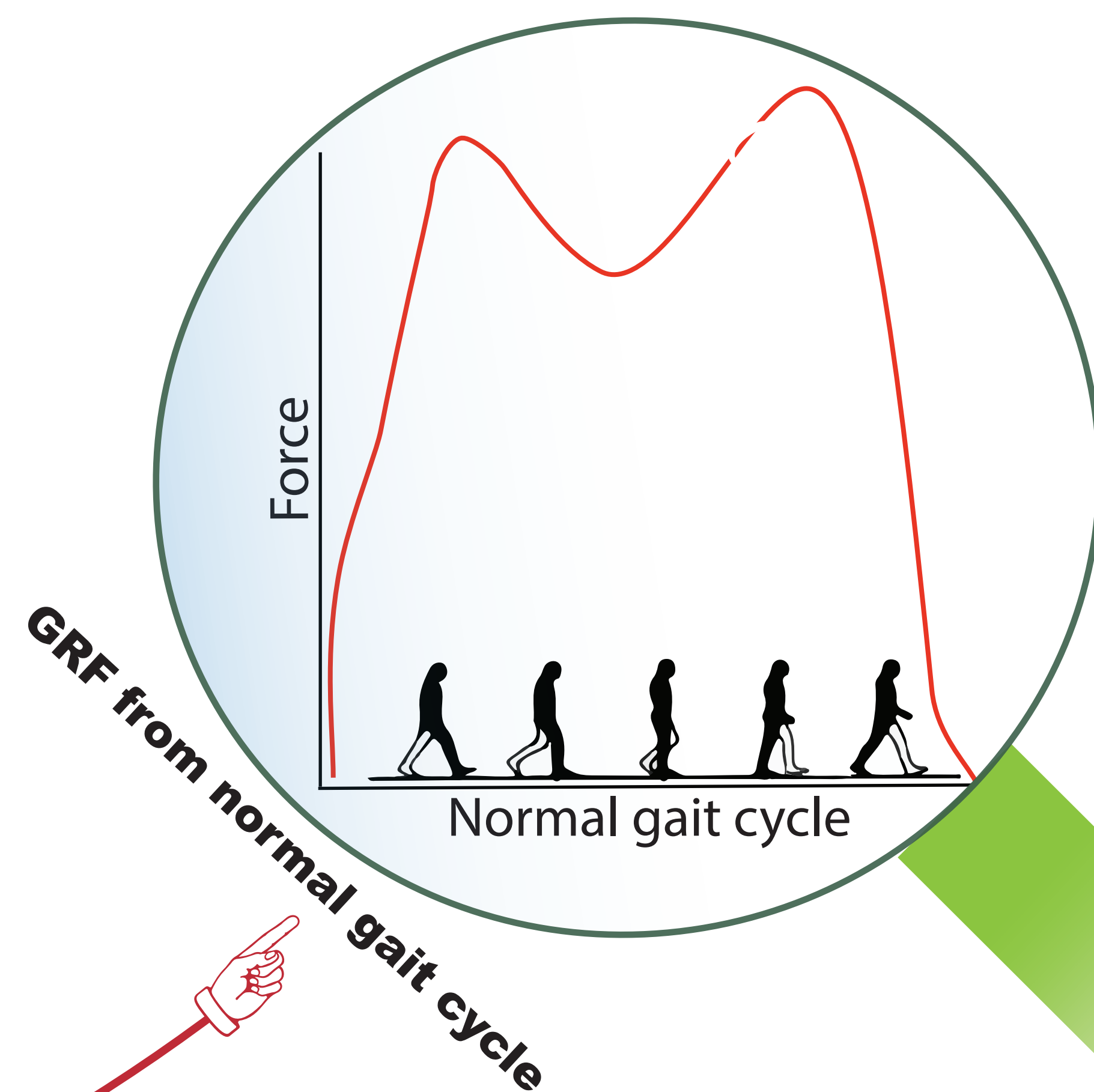
<sup>2</sup>Department of Health Science and Technology, Aalborg University, Denmark

<sup>3</sup>Department of Biomechanics and Orthopaedics, German Sport University Cologne, Germany



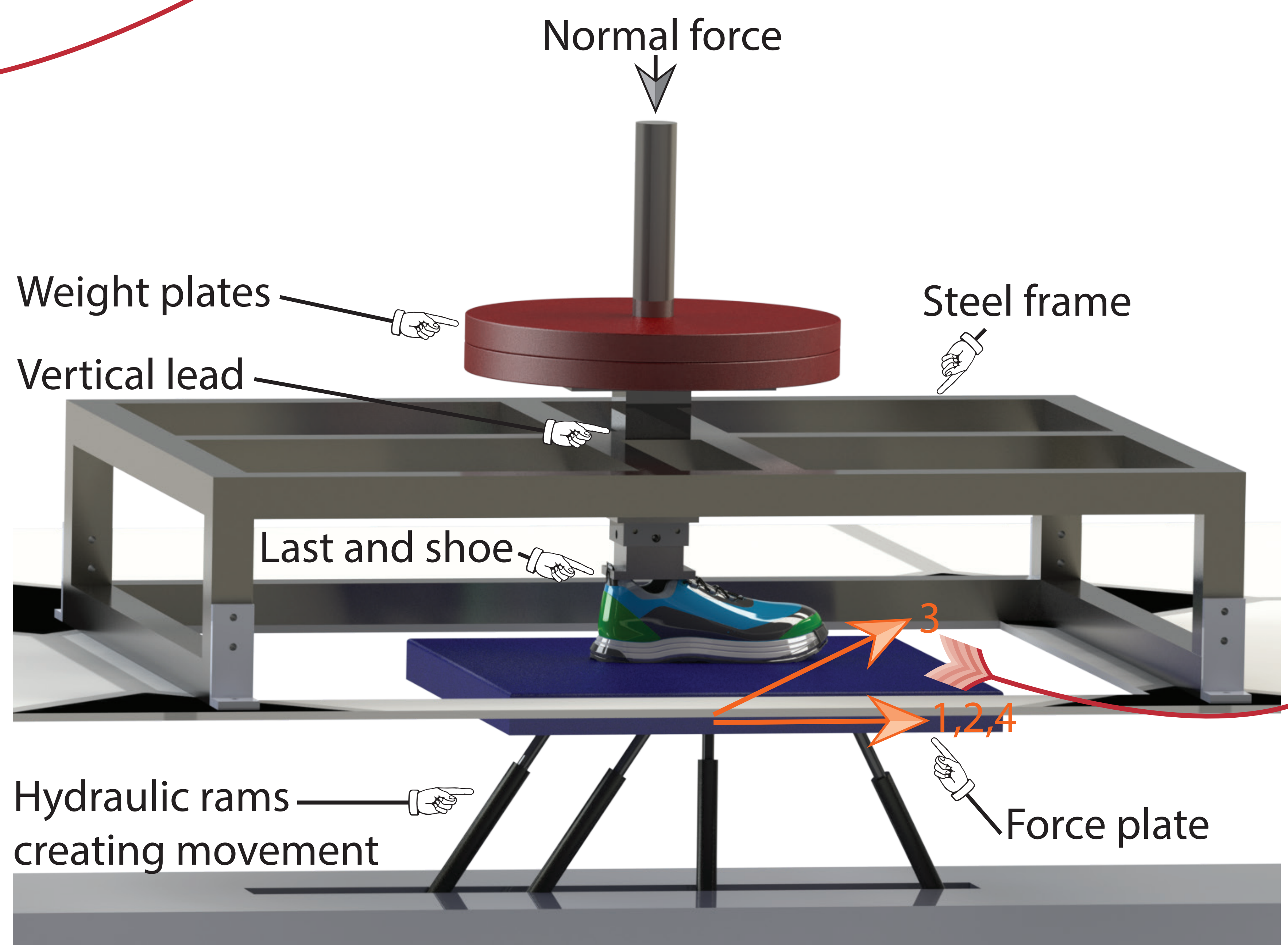
## INTRODUCTION

The contact mechanism between shoe and surface is crucial in order to avoid slipping and falling [1], enhance sporting performance or minimize the risk of sport injuries [2]. However, studying this contact mechanism, between footwear and surface, is challenging and violates the traditional Amontons–Coulomb's law of friction, due to the viscoelastic outsole materials [3]. Hence, replicating the biomechanical test conditions are of great importance, when determining the friction properties of footwear [1]. The aim of this study is to present a test-setup able to replicate biomechanical relevant test conditions.

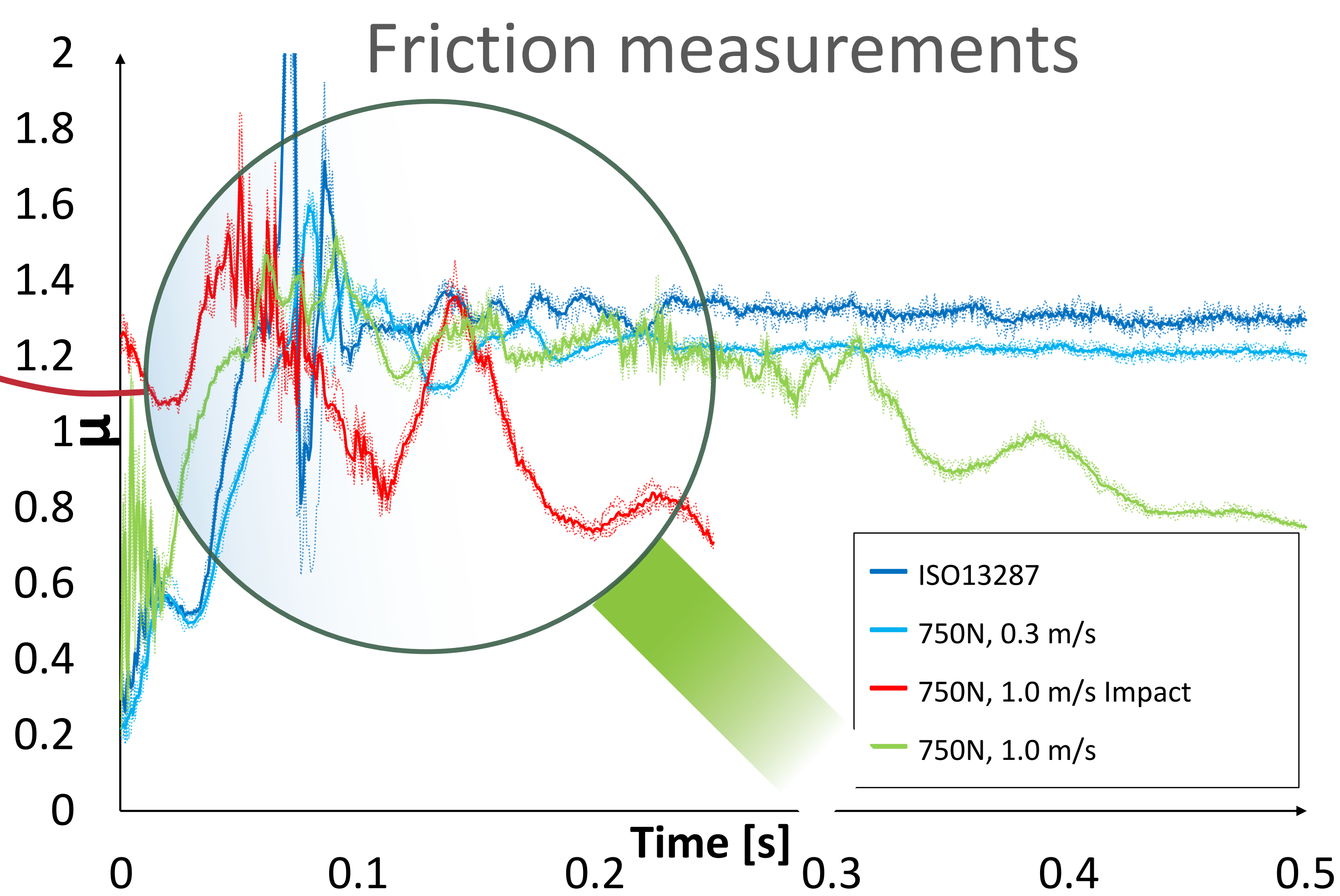


## METHOD

The test-setup consisted of a steel frame designed to maintain the position of a shoe, mounted above a force plate. The force plate is attached on top of a hydraulic platform (Ser-man-Tipsmark, Brønderslev, Denmark), which makes it possible to move vertical and horizontal. Four different test conditions were performed: 1) Drag-test according to ISO 13287 (normal load (NL) 500 N, sliding velocity (SV) 0.3 m/s); 2) Drag-test (NL 750 N, SV 0.3 m/s); 3) Impacting, with the platform moving both horizontal and vertical (NL 750 N, SV 1.0 m/s), and 4) Drag-test (NL 750 N, SV 1.0 m/s). We recorded five trials for each condition.



## RESULTS



## CONCLUSION

This study presents a new test setup that can characterize the tribological behavior of shoe and surface in a traditional way, by following the traditional ISO 13287 standards, but more importantly also being able to add a novel impacting approach to the test of footwear, which is arguably more biomechanically relevant.

References