Presentation title: **Engineering the Interaction between Footwear Design, Soil & Turf Properties and Human’s Biomechanics**

Corresponding Author name: **Veit SENNER, Prof. Dr.-Ing.**

|  |
| --- |
|  |

Affiliation: **TECHNICAL UNIVERSITY OF MUNICH**

**TUM School of Engineering and Design**

**Professorship Sport Equipment and Sportmaterials**

[https://www.mec.ed.tum.de/en/spgm](https://www.mec.ed.tum.de/en/spgm/homepage/)

Ph. No: **+49 89 289 15366**

Email ID’s: **senner@tum.de**

WhatsApp No: **n.a.**

ORCID-ID: **0000-0001-5136-7580**

Other Authors if any: **Valentin WOHLGUT, Robin COMPEYRON, Bahador KESHVARI**

Presentation type: **Oral**

**Abstract** (250-300 words):

3D-printing technologies, wearable sensors, powerful processors and machine learning offer great opportunities for innovative products, not only for sports, but also for robotics, ambient living or rehabilitation. However before we can make use of these, it is essential to systematically gain knowledge to understand the sensory-motor coupling in human motion. Modeling and simulations based on sophisticated experiments, but also on subjective ratings are the key to explore cause-effect-relationships, relevant confounding variables and to distinguish them from individual variability.

The presentation will take a look at footwear design, such as the stud configuration, the boot sole’s friction behavior, the shoe’s mass or the sole’s deformation behavior under load. It will also consider the mechanical properties of the shoes’ intermediate sole and its insole and how these interact with varying soil and turf conditions. Examples from trail running and typical soccer maneuvers, practiced on the sports field but also in steep stony terrain will be shown. The major focus of this talk will be on the wide spectrum of methods necessary to gain knowledge. They range from in vivo elasticity and damping measurements at the foot sole, to ground reaction force measurements with buried force plates, Laser Speckle Contrast Imaging (LSCI), leg-surrogate-studies and co-simulation using both, multi-body-models of human muscle-skeletal system and finite element models of the foot, the shoe and of different type of soil.

**Biography (150-200 words):**

Veit SENNER is associate professor at Technical University of Munich (TUM), School of Engineering and Design. He holds an academic degree in mechanical engineering and a second one in sport science. 1995 he started his career in industry at TÜV SÜD, Germany’s leading trusted body for certification of quality systems. During his time in industry he continued to work on his University career, receiving his Ph.D in Mechanical Engineering (Dr.-Ing.) in 2001. One year later he has been appointed as associated professor at TUM. Since then he is heading the professorship for Sport Equipment and Materials, which today is part of the department of Mechanical Engineering. Between 2005 and 2009 he has served as Associate Dean for the Faculty of Sport Science. In 2021 he has taken over the responsibility as Academic Program Director for the School’s study courses in mechanical engineering.

Senner’s research is focusing on human-centered engineering, biomechanics, athlete equipment interaction, personal protection gear and wearables.

He has supervised 20 dissertations and 28 as co-supervisor or second examiner. He has published more than 100 articles in national and international journals as first and as co-author (97 listed in scopus), his actual h-index is 13.