Sliding tester – a device to measure temperature and friction during sliding

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DESSO DLW
SPORTS SYSTEMS
Overview

• introduction
• goal
• experimental setup
• results & discussion
• conclusion
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Introduction

• artificial turf: widely used in tennis, hockey, ...

• 3rd generation artificial turf: increased use in football

• players & clubs still have some resistance
Introduction

• the problem of artificial turf: **sliding**
• risk of burning and abrasion injuries

• ISA Sport (2003): 62% of players find artificial turf unsuitable for making sliding tackles → need for measurement method
Introduction

• existing test device: Securisport (FIFA, UEFA)
  ‣ measurement of coefficient of friction (COF) and abrasion
  ‣ no temperature measurement
  ‣ rotational movement
  ‣ low speed & pressure
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Goal

• develop a new test device in order to assess the risk of sliding injuries on different types of artificial turf
• realistic approximation of a sliding
• realistic values for player speed and mass, which can be varied
• friction and temperature measurement
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sledge
ramp
field
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The graph shows the temperature [ºC] over time [s]. The temperature increases sharply initially and then decreases gradually over time.
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Experimental setup

- velocity: up to 22km/h
- sledge mass: 15→31kg
- bottom of sledge: newly developed artificial skin
- thermocouples inside skin (1000Hz)
Temperature and sliding distance measurement

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Results

• temperature rise & sliding distance

\[ \text{COF} = c \left( \frac{h}{L} \right) \]
Results

• temperature rise & COF

![Bar chart showing temperature rise and COF comparison]

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Results

• influence of mass of sledge
  ‣ \( E_{\text{kin}} = \frac{mv^2}{2} \rightarrow \text{linear} \)
Results

- influence of initial speed of sledge
  ‣ $E_{\text{kin}} = \frac{mv^2}{2}$ → quadratic?
  ‣ $L \sim v$ → more cold turf in contact with skin
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Conclusion

- new test device: risk of sliding injuries on different surfaces
- realistic approximation of a sliding
- realistic values for player speed and mass, which can be varied
- friction and temperature measurement
Conclusion

- classification of surfaces based on COF is not correct
- classification based on temperature seems more significant: the lower the temperature rise, the better
- temperature rise on natural turf < on artificial turf
Future work

• integration with abrasion measurements
• more testing on other conditions (frozen, wet, … fields)
• maximum value for the skin temperature should be set
Experimental setup
Experimental setup
Experimental setup
Experimental setup
Experimental setup