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# IMPACT OF THE ANGULAR VARIATION OF THE TRUNK DURING A PROPULSION CYCLE USING INERTIAL MEASUREMENT UNITS (IMU)

FLORIAN BRASSART<sup>1,3</sup> ; DIDIER PRADON<sup>2</sup> ; ERIC WATELAIN<sup>1</sup> ; SADATE BAKATCHINA<sup>1</sup> ; ILONA ALBERCA<sup>1</sup> ; THIERRY WEISSLAND<sup>3</sup> ; ARNAUD FAUPIN<sup>1</sup>

<sup>1</sup>Université de Toulon, IAPS - N°201723207F, 83957 La Garde, France ; <sup>2</sup>Pole Parasport - ISPC Synergies, CHU Raymond Poincaré, APHP, Garches, France ; <sup>3</sup>Laboratoire IMS, UMR 5218, PMH\_DySCo, Pessac, France.

[florian.brassart@univ-tln.fr](mailto:florian.brassart@univ-tln.fr)

**Introduction :** Different propulsion strategies exist in wheelchair sports depending on the sport, equipment, and classification of the athlete. In athletes with high classifications, and therefore greater trunk muscles strength, have greater involvement of the trunk during a sprint, whose varies with pushing velocity [1]. One study showed that isometric trunk strength in wheelchair athletes was not directly correlated with the acceleration as the latter depended on rolling resistance [2]. But in this study, the dynamic action of the trunk was not measured during propulsion. For this reason, it would be interesting to study the influence of trunk movements during propulsion in sports requiring more mobility such as wheelchair basketball.

**Hypothese:** The flexion/extension range of motion of the trunk (FEROMT) have an impact on the variations in velocity during a sprint.

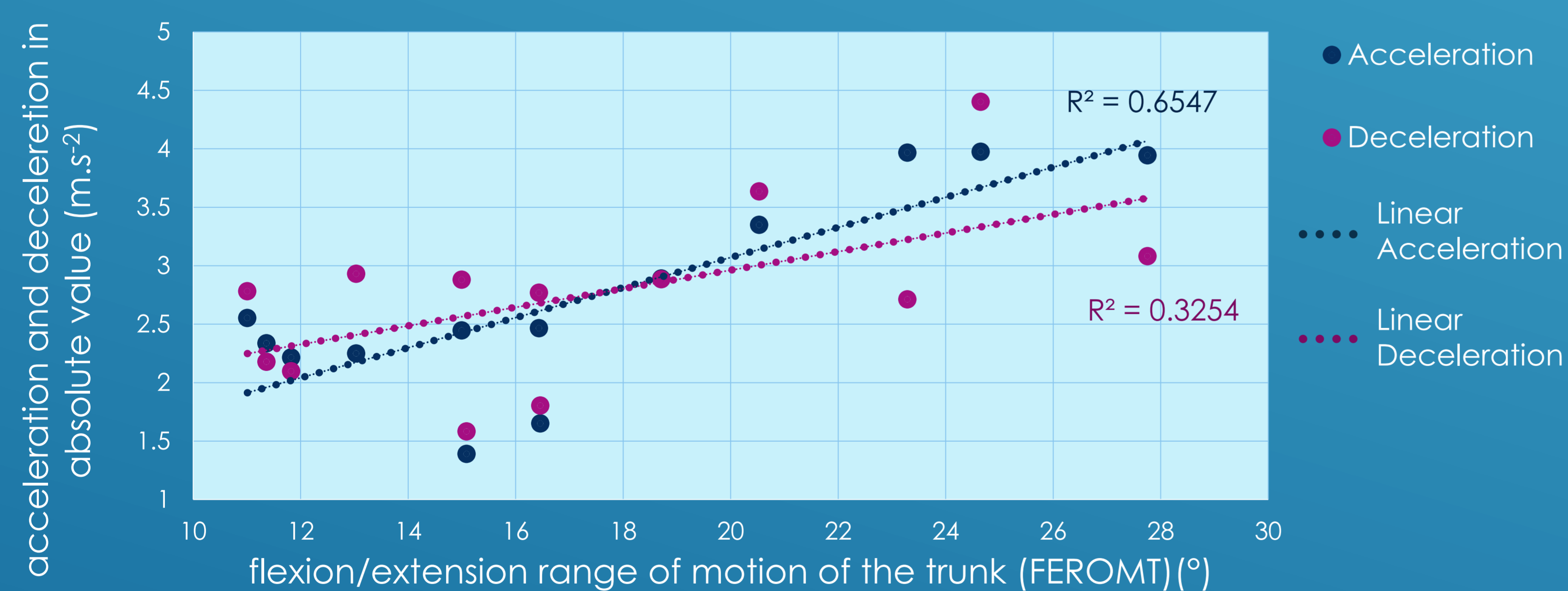
**Protocol :** 13 elite female wheelchair basketball players 5 with a classification at 3.5 and above (high points) and 8 with a classification lower than 3.5 (small points) with their own sports wheelchair.

The players ran 6 x 20 m sprints successively in a straight line with 20 seconds of recovery between each.

## Results :

- **Correlation** between the **mean acceleration** per pushing phase and **FEROMT** ( $p=0.015$ ).
- **No correlation** between the **mean deceleration** per recovery phase and **FEROMT** ( $p=0.103$ ).
- **No correlation** between the **classification** of athletes and **FEROMT** ( $p=0.068$ ).

However, on average high points had a greater FEROMT than small points ( $21.52 \pm 6^\circ$  and  $14.7 \pm 2.6^\circ$ ,  $p=0.00017$ ) as seen in the literature.



**Figure 2 :** Relationship between the mean acceleration (blue) / deceleration (purple) and the mean FEROMT for each cycle of propulsion during the sprint for each players.

IMUs were placed :

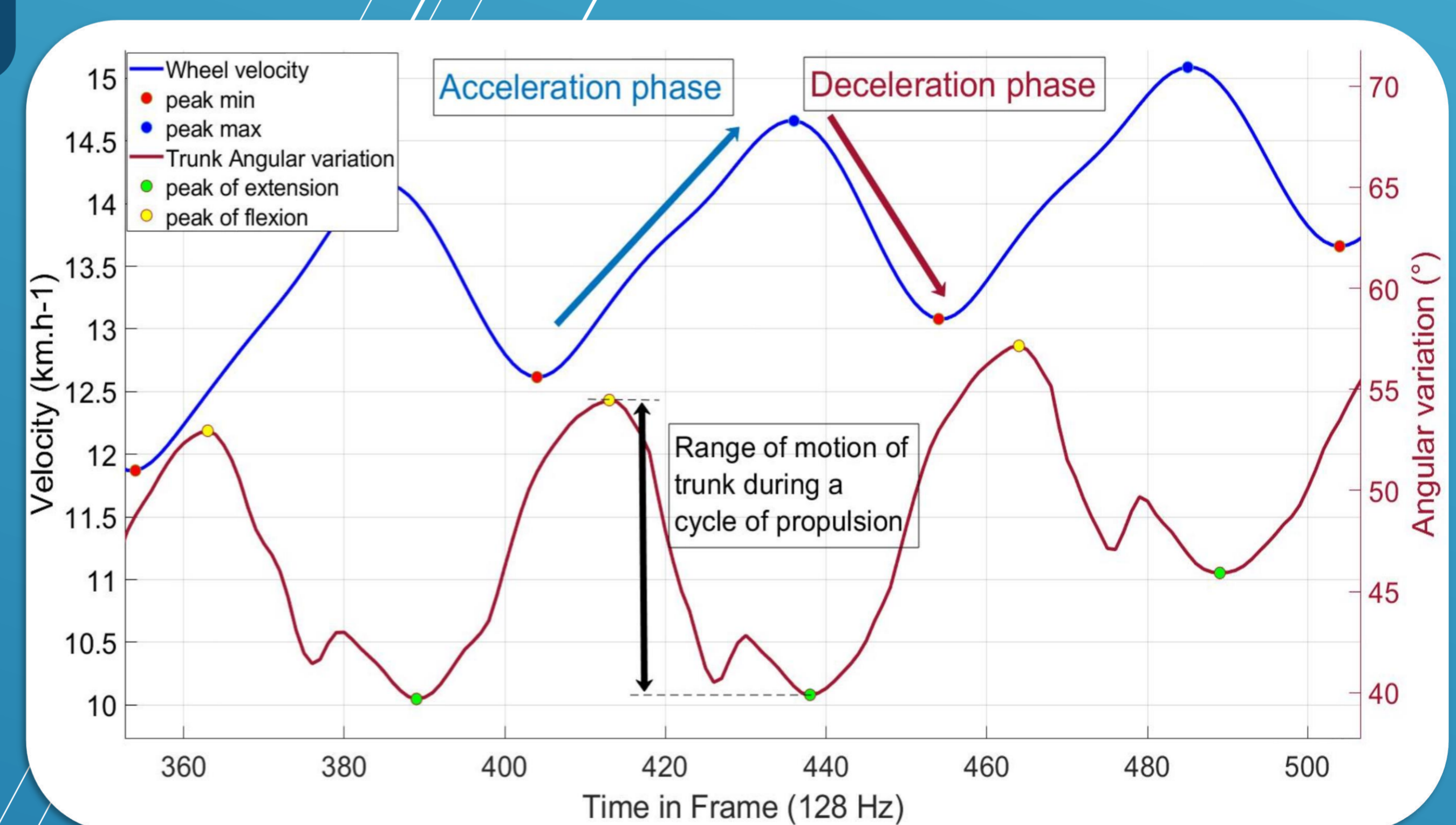
- on the spokes of each wheel [3]
- in the center of the back at the spine level, **between Th2 and Th8**

**IMU measured the rotation velocity of the wheels and the trunk with integrated gyrometers**

→ Compute of wheels linear velocity and FEROMT



**Figure 1 :** Female wheelchair basketball player during a sprint with 3 IMUs.



**Figure 3 :** Wheelchairs velocity and trunk variation during 3 cycles of propulsion of a 20 m sprint.

**Discussion :** FEROMT seems to differ according to classification however differences are not systematic. The movement of the trunk during wheelchair propulsion appears to be beneficial in order to accelerate without increasing the deceleration during the recovery phase. This could indicate that trunk motion is beneficial to performance, bringing further insight to the study of Vanlandewijck et al. (2011) [2].

## Bibliography

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