Research on the Acceleration and Trunk Posture while Riding a Bicycle

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Abstract

In this study, we measured the acceleration of a bicycle and the trunk posture of a rider are measured using the 9-axis motion sensor. The results indicate that the rider consciously maintains the trunk posture the uneven road surface. In future, we will analyze the cooperation between maintaining trunk posture of a rider and the acceleration of a bicycle.

People enjoy cycling because they can travel under their own power, at their own pace, in a way that is both stimulating and relaxing. Bicycle competition includes racing [1], BMX racing, track racing [2], criterium, roller racing, sportives and time trials. A rider receives constantly vibration transmitted from a road surface while riding a bike. Since the vibration increases on a road with rough surface, maintaining an appropriate posture enable to apply force to the pedal.

From the above, evaluating the relationship between the vibration transmitted from a road surface and the trunk posture of a rider enables to clarify how a rider keeps balance while riding a bike. Therefore, in this study, the acceleration of a bicycle and the trunk posture of a rider are measured using the 9-axis motion sensor. The acceleration of a bicycle and the trunk posture of a rider on two different road surfaces are compared.

A healthy adult male (height 1.73 m, weight 75 kg) participated in the experiment. The measurement was conducted at two locations in Hachioji City, Tokyo. Following an explanation of the purpose and requirements of the study, the participant gave his written informed consent to participate in the study. Study approval was obtained from the Research Ethics Board, Kogakuin University. Fig. 1 shows the sensor positions. The analysis was conducted focusing on the acceleration of a bicycle and the trunk posture.

The flexion - extension of the trunk and the acceleration of a bicycle are shown in Figs. 2 and 3, respectively. On a flat road, the acceleration in the riding direction fluctuates within ±0.5 [G] and the trunk posture fluctuates around 0 degrees roughly except the time when the rider begins to ride. While the acceleration in the traveling direction fluctuates greatly within ±2.0 [G] and the trunk posture consciously maintains the bend of about 10 degrees thereafter on uneven road surfaces.

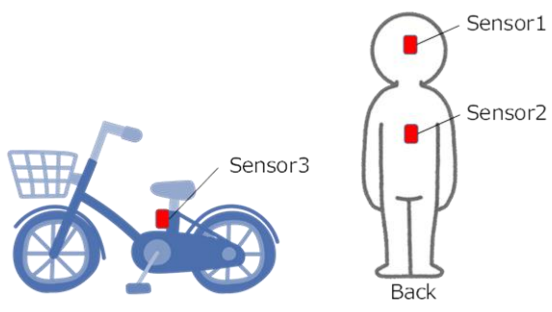

Fig. 1. Sensor positions

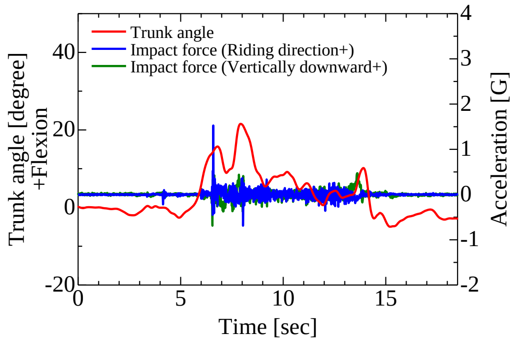

Fig.2 Flat condition

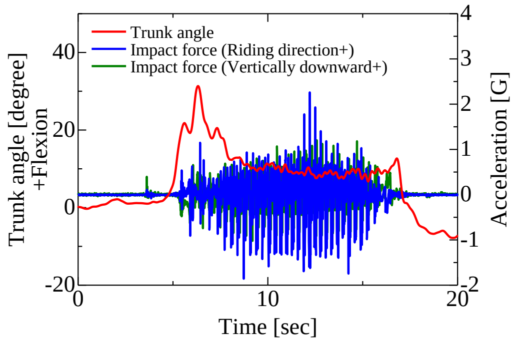

Fig.3 Unevenness condition

References:

[1] Y. Ochi, *Transactions of Japanese Society for Information and Systems in Education*, **31**, 91-103 (2017).