

Validity of a Timing System in the Alpine Ski Field: A Magnet-Based Timing System Using the Magnetometer Built into an Inertial Measurement Units

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Abstract : There is a long way to explore all the possible applications inertial measurement units (IMUs) have in the sports field. The aim of this study was to evaluate the validity of a new application on the use of these wearable sensors, specifically it was to evaluate a magnet-based timing system (M-BTS) for timing gate-to-gate in an alpine ski slalom using the magnetometer embedded in an IMU. This was a validation study. The criterion validity of time measured by the M-BTS was assessed using the 95% error range against actual time obtained from photocells. The experiment was carried out with first-and second-year junior skiers performing a ski slalom on a ski training slope. Eight alpine skiers (17.4 ± 0.8 years, 176.4 ± 4.9 cm, 67.7 ± 2.0 kg, 128.8 ± 26.6 slalom FIS-Points) participated in the study. An IMU device was attached to the skier's lower back. Skiers performed a 40-gate slalom from which four gates were assessed. The M-BTS consisted of placing four bar magnets buried into the snow surface on the inner side of each gate's turning pole; the magnetometer built into the IMU detected the peak-shaped magnetic field when passing near the magnets at a certain speed. Four magnetic peaks were detected. The time compressed between peaks was calculated. Three inter-gate times were obtained for each system: photocells and M-BTS. The total time was defined as the time sum of the inter-gate times. The 95% error interval for the total time was 0.050 s for the ski slalom. The M-BTS is valid for timing gate-to-gate in an alpine ski slalom. Inter-gate times can provide additional data for analyzing a skier's performance, such as asymmetries between left and right foot.

Keywords : gate crossing time, inertial measurement unit, timing system, wearable sensor

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