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MODELLING THE CONDITIONS OF MULTIPLE ROTATIONS OF THE „WILDCAT” SIDE FLIP IN SNOWBOARD

SUMMARY

Snowboarding is a relatively young sport, as it started in the 1960s. It originated as a youth rebellion against popular traditional skiing. In not more than twenty years since the first snowboarding tournament it has been added to the Winter Olympics programme, which clearly states its position stemming from its dynamic development. High level of snowboarding proficiency shows more than sliding down the slope and includes doing tricks after having jumped up in the air. Progressing in the above is related to a suitable learning process, even though some handbooks encourage to experiment and ‘chill’ in order to pursue ‘freestyle’. Therefore, a lot of discretion on snowboarding results from randomness in extending one’s kinaesthetic skills while ‘playing with the board’.

Telling from other sports’ experience it has to be said that a controlled way of kinaesthetic education and acquiring new skills is seemingly more effective, durable, and – most of all – safe for a trainee. In order to orientate training processes we need to cognize the movement we are teaching and to define the processes’ aim with everything that infects it. Currently, modern technical solutions and specialized measuring tools allow us to gather all the essential information on ‘external and internal movement structure’ to describe technique. Thanks to applying such methods we can fully understand a kinaesthetic action being performed and point out which factors are essential in its realisation, having an impact on its final results. These factors are isolated by searching for functional relations between movement variables and aiming variable. Such a concept is a base for creating a deterministic model of qualitative movement analysis. This model may constitute a starting point and a theoretical base for biomechanical studies in sport – helping to explain, instead of just describing, mechanical aspects of sporting results. It has been used in sports, incl. swimming, athletics and gymnastics and added strongly to achieving better and better results.

The reasons behind choosing such a PhD thesis topic are a shortage of professional literature in the area of snowboarding tricks' structure description and a lack of evaluation in mechanical variables' impact on performing given tricks. Available publications focus mainly on landing, omitting the phase of flying – an important part for successful task (trick) performance.

The main aim of this thesis is devising and validating a mathematical model for the flying phase of a snowboard flip called 'Wildcat', which is a backward (sideflip) somersault performed sidewise, i.e. in competitor's anatomical frontal plane.

The following stages have been assumed:

1) a description of kinematical phase of flight in a single 'Wildcat' flip;

2) identification of movement variability for the flying phase of a single 'Wildcat' flip;

3) a development of a model for the flying phase of a single 'Wildcat' flip using a point based model and elipsoid model body inertia taking account of movement variability and starting conditions;

4) defining conditions for performing a double 'Wildcat' flip using the model;

5) validating the model by comparing empirical results to the results acquired at the flying phase of a double 'Wildcat' flip.

The first stage describes phase structure of flight while performing 'Wildcat' flip, pointing out to three criteria of phase division developed for three kinds of movement in this trick, i.e. forward progression and circular motion of the body (in a global frame of reference) whilst changing respective body parts' position (in a local frame of reference). A centre of mass position of the layout was chosen (i.e. snowboarder's body along with a snowboarding set) in a vertical axis, the first invariant of inertia tensor (i.e. aggregate inertia moment of the body or equipollent aggregate inertia moment of the inertia ellipsoid) and the position of the snowboarder's body in the plane of flight. During the making of the records two strategies of performing the 'Wildcat' flip were identified, they were called 'U' and 'V' according to the time characteristic of the aggregate inertia moment.

The second stage determined levels of variability in a single 'Wildcat' flip. Focusing on analysing the examined, i.e. comparing realization of the task by different snowboarders and the average result for the whole group; the moment of movement realisation, i.e. comparing tidal moments on the edges of flight phases and during the whole flight; the type of variable, i.e. comparing the variables for three kinds of movement for the 'Wildcat' flip. Moreover, identification of variability within the two strategies for performing the trick ('U' & 'V') was taken into account. A classical coefficient of variation (CV) and biological coefficient of variation (BCV) were used.

The third stage determined the variables having impact on the results set for the 'Wildcat' flip, creating a so-called deterministic model of movement. A model for the flight phase was made with use a point based model and elipsoid model body inertia built on the main axes.

In stage four we started to model a double 'Wildcat' flip. Such edging variables' values were obtained that the model indicated performing a double 'Wildcat' flip based on 'safe landing' policy. Respective steps of modeling were established validating the choice of certain model's initial variable values.

In stage five the model was validated by comparing model scores to empirical data obtained from conducting the research. The validation was held in three parts: empirical data obtained from average double flips realisation was implemented both for the 'U' and 'V' strategies to verify the model angle of body axis while landing with an effective result; next, there was a comparison of edge variable sets from the empirical data obtained from average double flips realisation with the data implemented for modelling, conditioning the realisation of a double flip in accordance with the model outcome; in the end the empirical data from specific, chosen performances of double flips were input to the 'U' & 'V' strategies programmes to verify a model angle for the body axis while landing with an actual result of such an attempt. An affirmation of the legitimacy of the model was a result, showing its strengths and weaknesses.

All of the planned stages of this work have been conducted, which allowed to describe the kinematic phase of flight, the assessment of this motion, design and produce a model regarding progressive and circular motions factors of the snowboarder – snowboarding set layout, determine the edge conditions for a double flip's realisation and validate the model. As a result we got an application which can be used by coaches in the practice planning process, and also while searching for ways to develop snowboarder's skills in safe conditions.