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ABSTRACT

A flight parameter measuring apparatus and method includes: an image corresponding part that generates a first registered ball image by making a size of a first ball image correspond to a size of a second ball image; a 3D model constructing part constructs a 3D model of the first registered ball image in a world coordinate system; a virtual rotating part 205 virtually rotates the constructed 3D model; a registered image generating part generates a second registered ball image in a camera coordinate system; a difference calculating part extracts a second compared ball image in the second ball image and calculates a difference between the second registered ball image and the second compared ball image; and a rotation parameter determining part repeats the virtual rotation of the 3D model, the generation of the second registered ball image and the calculation of the difference by changing an initial rotation parameter.

Description

Title of Invention: FLIGHT PARAMETER MEASURING APPARATUS AND FLIGHT PARAMETER MEASURING METHOD

Technical Field

[0001] The present invention relates to a flight parameter measuring apparatus and a flight parameter measuring method.

Background Art

[0002] Traditionally, techniques for measuring the flight parameters (launch parameters) of the ball, such as a golf ball exist a lot. For example, Patent Literature 1 discloses a method of measuring launch parameters of an object in flight. The method comprises capturing a plurality of images of an object in flight, identifying a radius of the object and a center of the object in each of the plurality of images, and calculating a velocity, an elevation angle, and an azimuth angle based on the radius of the object, the center of the object, and pre-measured camera alignment values. Further, the method comprises cropping the plurality of images to a smallest square that bounds the object, flattening the plurality of images from spherical representations to Cartesian representations, converting the Cartesian representations to polar coordinates with a range of candidate centers of rotation, and based on a fit of the polar image pair, measuring the spin axis and spin rate.

[0003] Patent Literature 2 discloses a method for determining parameters of an object in motion. The method comprises the steps of calibrating a camera lens to establish (x, y, z) directions for every (x, y) pixel in an image plane of the camera, determining alignment correction factors, capturing a plurality of images of the object in motion, finding

Patent Literature

[0004]

Patent Literature 1

[0005] Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2016-540185

Patent Literature 2

[0006] Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2005-529339

Summary of Invention

Technical Problem

[0007] When a flight parameters of a ball are calculated based on a ball image photographed with a camera, various image processing methods exist, and an effective method is exploring. In the mentioned Patent Literature 1 and 2, it is problem that there are many processes (step) required for a measurement of the flight parameters, are complicated, and a processing capacity and a processing time are necessary. And, an accuracy of the measured flight parameters is unknown. Here, the flight parameters usually include a motion parameter to mean a ball speed, a launch angle and a side angle of an object in motion, and a rotation parameter to mean a spin axis and a total spin of the object, but it is very hard to calculate the rotation parameter accurately.

