

Design and Development of Optical Sensor Based Ground Reaction Force Measurement Platform for GAIT and Geriatric Studies

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Abstract : This paper describes an ab-initio design, development and calibration results of an Optical Sensor Ground Reaction Force Measurement Platform (OSGRFP) for gait and geriatric studies. The developed system employs an array of FBG sensors to measure the respective ground reaction forces from all three axes (X, Y and Z), which are perpendicular to each other. The novelty of this work is two folded. One is in its uniqueness to resolve the tri axial resultant forces during the stance in to the respective pure axis loads and the other is the applicability of inherently advantageous FBG sensors which are most suitable for biomechanical instrumentation. To validate the response of the FBG sensors installed in OSGRFP and to measure the cross sensitivity of the force applied in other directions, load sensors with indicators are used. Further in this work, relevant mathematical formulations are presented for extracting respective ground reaction forces from wavelength shifts/strain of FBG sensors on the OSGRFP. The result of this device has implications in understanding the foot function, identifying issues in gait cycle and measuring discrepancies between left and right foot. The device also provides a method to quantify and compare relative postural stability of different subjects under test, which has implications in post surgical rehabilitation, geriatrics and optimizing training protocols for sports personnel.

Keywords : balance and stability, gait analysis, FBG applications, optical sensor ground reaction force platform

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