



Sensor Fusion Technique for Tilt Estimation using a Gyroscope and a Three-axis Accelerometer : Formulation and Validation

Jongwoong Park*, Cheng Liu, Fan Jiansheng, Billie F. Spencer Jr.

* *Presenting Author*

*Corresponding Author: Jongwoong Park
Contact Email: jongwoon@illinois.edu*

ABSTRACT

Tilt measurement provides useful information on structural health monitoring for deflection estimation, damage detection and so on, but precise dynamic tilt estimation of a structure is very challenging due to insufficient dynamic characteristics of existing inclinometers. This study focuses on developing complementary filter that fuses low-frequency component from tilt estimated by 3-axis accelerometer and high-frequency component by gyroscope so that advantageous sensor characteristics are extracted for the fusion signal. Therefore, a precise complementary filter model was designed and analyzed to achieve wide frequency range estimation of the real tilt angle. Finally, a numerical simulation on 5MW wind turbine model was carried out to extract angular velocity and 3-axis acceleration to validate the proposed complementary filter.

KEYWORDS: *Tilt Measurement, Sensor Fusion, Complementary Filter*