

Abstract

The Council for Scientific and Industrial Research's Sensor Science and Technology discipline has developed a multi-sensor camera (which consist of ultraviolet, infrared and visual lenses) capable of diagnosing HV/MV power transmission lines for hot/cold spots, corona effects and visual defects of conductors, towers and pylons. This camera is planned to be mounted on a double-gimbal platform, which will be suspended on a rotary-unmanned aerial vehicle for the autonomous inspection of power transmission lines. The work presented in this dissertation focuses on the robust modelling and control of the gimbal assembly. The purpose of this is to ensure smooth and jitter-free motion of the gimbal against mechanical vibrations, sensor and actuator noise, and disturbances so that the images that are captured by the camera are not distorted. The work encompasses modelling the gimbal using the Lagrangian theory and applying Proportional Integral Derivative control, Ziegler-Nichols tuning and Integral Square Error, Integral Absolute Error, Integral Time Square Error, Integral Time Absolute Error tuning techniques, robust H_∞ , Quantitative Feedback Theory and Model Reference Adaptive Control to stabilise the assembly against the aforementioned disturbances and parametric model uncertainty. The results obtained indicate favoritism towards the frequency domain robust control algorithms over the standard Proportional Integral Derivative controller, even when it is auto-tuned.