POSITION BASED FRICTION ESTIMATION FOR PRECISE MOTION CONTROL

MahawaththeKodithuwakkugeChathuranga Dinesh Chinthaka
(138038N)

Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Dr. A.M.HarshaS.Abeykoon

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MahawaththeKodithuwakkugeChathuranga Dinesh Chinthaka

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ABSTRACT

Friction is often neglected in DC servomotor applications. It valid if the servo motor is small and the frictional torque elements are small when compared to the motor torque. Fixed friction and viscous friction are the main constitutes of the friction. For precise motor control applications, friction could not be neglected. In many applications, researchers have attempted to estimate an average for a whole rotation. In the first stage of this research work frictional components have been estimated using constant angular velocity motion test and by the use of disturbance observer. Disturbance observer based friction compensator has been modeled and developed model was subjected to stability analysis and further evaluated using simulation results andimplemented in hardware setup. Estimated average friction values have been used in modeled disturbance observer based friction compensator and verification of the estimated values was done by practical results.

However even these estimation values are not valid for applications when it is having rotor wide frictional distribution. Friction is depending on the material in contact, surface of the contact plane and the normal contact force. These factors are continuously changing due to the relative motion between rotor and the stator. Frictional values are subjected to change with the orientation of the rotor and the direction of rotation. Magnitude of the frictional values could expectto be repeated for forthcoming rotations also for one direction. This research attempts to estimate the friction around 360^0 degrees of rotation in the second stage. Disturbance Observer is used as the torque measurement tool. Results show the estimated frictional values using the proposed method.

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