INFORMATION ON RESEARCH RESULTS

Dissertation title: RESEARCH, ANALYZE AND EVALUATE THE INFLUENT OF CABLE SAGGING TO THE POSITION ACCURACY OF CDPR

Major: Mechanical Engineering Major code: 9520103

PhD candidate: Tuong Phuoc Tho

Supervisor one: Assoc. Prof. Nguyen Truong Thinh

Assoc. Prof. Truong Nguyen Luan Vu

1. Academic contributions:

The thesis " Research, analyze and evaluate the influent of cable sagging to the position accuracy of CDPR" has reviewed and synthesized related studies, thereby realizing the research objectives including contributions to the theoretical and scholarly as follows:

- Design algorithms to determine cable tension distribution with flexible optimization criteria to be able to select optimal conditions corresponding to the specific CDPR structure and impact force boundary conditions. Based on this result, analysis of the impact of cable tension on the workspace of the constrained redundant CDPR;

- Design 3 algorithms to determine cable sagging, including TRDA cable sagging calculation algorithm based on the Trust Region Algorithm, CSPA and ICSPA cable sagging prediction algorithm based on ANFIS according to the conditions of cable tension, cable characteristics and specific CDPR configuration. Integrate the problem of cable tension and cable sagging into the CDPR inverse kinematics calculation algorithm, perform simulations, and collect and evaluate results when applying the algorithm to determine cable sagging compared to other methods for constrained redundant CDPR structure. Analyze the impact of cable tension distribution methods and cable sagging on the position accuracy of CDPR, evaluate the relationship between cable tension, CDRP structure, cable sagging, and elasticity of the structure transmission;

- Experiment on a large CDPR with 6 degrees of freedom driven by 8 cables for complex tasks such as moving heavy objects, path interpolation, and virtual reality motion simulation. Analyze and evaluate the impact of cable tension and cable sagging on the accuracy of CDPR.

**2. New points formed from research results:**

Research results show that cable sagging directly affects the accuracy of CDPR. The calculation model was successfully built based on analyzing components affecting cable sagging, such as CDPR configuration, cable materials, load, and especially cable tension distribution algorithms because cable tension is the main component that determines the result of cable sagging calculation. Experimental results show that the cable sagging and cable tension calculation model has improved the accuracy of CDPR in the position control problem. The model has also been used to design the trajectory for real-time control applications, and the experimental results show that the system response is suitable for applications requiring high speed and load. This research result can be extended in many different directions, such as building new models to optimize the workspace, determining the cable tension distribution, and calculating the cable sagging, thereby simplifying the computation process, and making it easy to deploy complex CDPR configurations with low fees.

*HCMC, 14/8/2024*

**PhD candidate**

*(Sign and name)*