Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

CHONGHAN MA

B Eng (Hubei University of Technology, 201)

“Embedded System Design and Joint Motion Control
of a Quadruped Robot”

Department of Mechanical Engineering

Monday, April 20, 2020
10:00 A.M.
Remote Defence

Supervisory Committee:
Dr. Yang Shi, Department of Mechanical Engineering, University of Victoria (Supervisor)
Dr. Keivan Ahmadi, Department of Mechanical Engineering, UVic (Member)

External Examiner:
Dr. Xiaodai Dong, Department of Electrical and Computer Engineering, UVic

Chair of Oral Examination:
Dr. Elena Pnevmonidou, Department of Germanic and Slavic Studies, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies
Abstract

In recent decades, mobile robotics have become one of the fastest growing research fields. Compared with wheeled and tracked robots, legged robots can step over obstacles and traverse unstructured terrains. This thesis focuses on two main tasks for supporting the development of a quadruped robot, i.e., the robot embedded system design and the joint motion control.

To develop the robot embedded system fulfilling the technical requirements, a controller board using an ARM-based STM32 microcontroller is designed. First, we select the key components properly, according to the practical requirements and the marketing research. Then the onboard hardware architecture is proposed, and the circuit schematic diagrams for all the functional modules are designed. The specifications and a comparison of two versions of PCBs are also presented and analyzed.

Based on the designed embedded system, the actuators and sensors are tested, and selected to set up the robot experimental platform. Moreover, the firmware is configured, and the software is developed to control the position and velocity of the motors. Furthermore, the moving average filter (MAF) based cascaded PID control algorithm is designed, and is implemented to manipulate the robot joints. The experimental results demonstrate the effectiveness of the proposed control method.