

Fig. 2 Kinematics of a cable driven parallel robot

3. SYSTEM DESIGN

The concept of an extensible back-heating cable robot is demonstrated in Fig. 3. The prototype of an extensible back-heating cable robot $2 \text{ m}(W) \times 5 \text{m}(H)$ is developed based on the concept as shown in Fig. 4. In order to adjust the height of the robot for the different heights of the steel plates, two extensible lifts were utilized.

In order to validate the reachable workspace of the robot when the desired workspace is 3.2 m x 1.1 m, a test of reaching the boundary of workspace was conducted. As shown in Fig. 5, the robot successfully reached the boundaries of the desired workspace.



Fig. 3 Design of a back-heating CDPR



Fig. 4 Prototype of an extensible back-heating CDPR; (a) The lifts extended and (b) the lifts stored.



Fig. 5 Desired workspace $(3.2 \text{ m} \times 1.1 \text{ m})$ reached when the robot is extend to the height of 4.2 m

4. CONCLUSIONS AND FUTURE WORKS

A prototype of the extensible back-heating CDPR was successfully developed and its reachable workspace was validated. The accuracy of end-effector position will be validated and improved by considering the flexibility of the frame. Also, the back-heating process will be performed on shipyard as a field test to validate the effectiveness of the back-heating CDPR system.

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