

Layout Planning in a Robotic Fuel Cell Stack Assembly System

by

Simin Chai

An Abstract of a Thesis Submitted to the Graduate

Faculty of Rensselaer Polytechnic Institute

in Partial Fulfillment of the

Requirements for the degree of

MASTER OF SCIENCE

Major Subject: Mechanical Engineering

The original of the complete thesis is on file
In the Rensselaer Polytechnic Institute Library

Approved:

Stephen James Derby, Thesis Adviser

Rensselaer Polytechnic Institute
Troy, New York

July, 2009
(For Graduation August 2009)

ABSTRACT

Fuel cells have a huge prospect to replace the burning of fossil fuels in the future energy marketplace. Research in various fields related to fuel cells has been conducted to meet the needs of future demand and technology. Robotic stack assembly technology, as one of the most important fuel cell manufacturing challenges, has not been brought onto the forefront till 2005 at Rensselaer Polytechnic Institute. This thesis presents the detailed construction process and layout planning in an automated fuel cell stack assembly system with two Adept robots at Center for Automation Technologies and Systems of Rensselaer Polytechnic Institute. Analysis of the key metrics (e.g., cycle time, production rate, efficiency) of the automated assembly system has been carried out to provide a cause – and – effect understanding between the layout planning and the manufacturing performance. This robotic assembly system is capable to fully automate the fuel cell stack assembly process: the sandwiching of MEAs, bipolar plates and gaskets as well as the endplates clamping process with bolts and washers. New cell planning with part feeders, end effectors, sensors, and controls has been integrated into this Adept robotic assembly system compared with the previous Kuka's version (Laskowski, 2007). The Adept's version works reliably with a higher robot speed programmed than the Kuka's one. It is predicted that the current assembly system render a relatively high production rate at 25.9 pc/hr under a non – defect circumstance. Robot simulation technology has been introduced to optimize the layout planning in the future.