NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Fueling Robot Automates Hydrogen Hose Reliability Testing

Highlights in Research & Development

Automated robot mimics fueling action to test hydrogen hoses for durability in real-world conditions.

With at least three major auto manufacturers expected to release fuel cell electric vehicles in the 2015 to 2017 timeframe, the need for a reliable U.S. hydrogen fueling infrastructure is greater than ever. That's why the National Renewable Energy Laboratory (NREL), with funding from the U.S. Department of Energy Fuel Cell Technologies Office, is using a robot in the Energy Systems Integration Facility (ESIF) to assess the durability of hydrogen fueling hoses, a largely untested—and currently costly—component of hydrogen fueling stations.

Only one manufacturer in the world currently makes certified hydrogen fueling hoses—so not only are prices high with the current lack of competition and demand, but not much has been done to test the hoses' durability over time in a real-world environment. NREL's robot is programmed to meet this need. The automated machine mimics the repetitive stress of a human bending and twisting the hose to refuel a vehicle—all under the high pressure and low temperature required to deliver hydrogen to a fuel cell vehicle's onboard storage tank.

The sole German-based hydrogen hose manufacturer is highly interested in this testing and has provided hoses and extra hose material to NREL free of charge. The test plan for the hose reliability project includes not only testing the repetitive fueling motion under high-pressure and low-temperature conditions, but also analysis of the hose material itself to see how it degrades over time. Untested hose material characteristics will then be compared with those of the hoses that have been tested for thousands of cycles.

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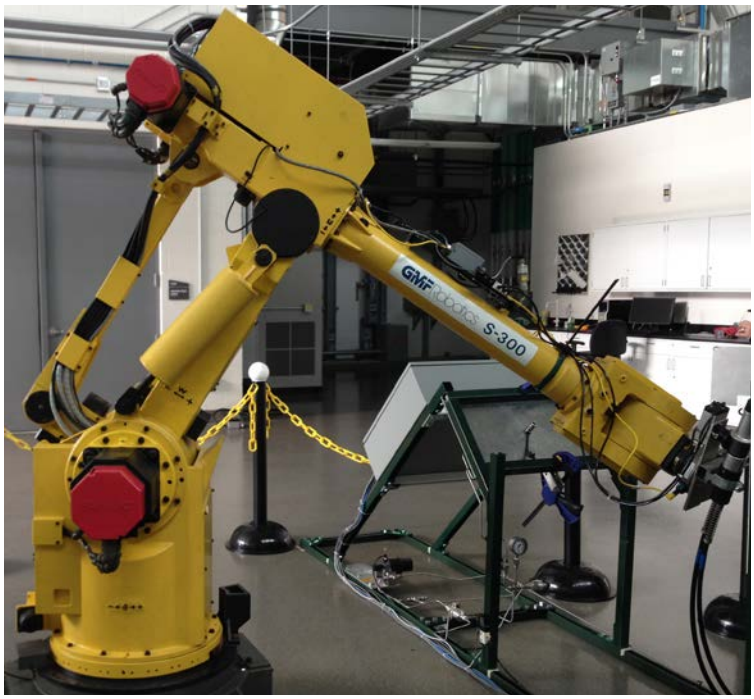
Reference: "Robot-Powered Reliability Testing at NREL's ESIF." YouTube video. *http://www.youtube.com/watch?v=Rbc7f01oP8k*.



NREL's goal is to run hydrogen hoses through tens of thousands of fill cycles to see how they withstand repeated use—and with its autonomous functionality, the fueling robot makes this kind of long-term, accelerated testing as simple as pushing a button. Photo by Devonie McCamey, NREL 28806

Key Research Results

Achievement

NREL programmed a robot to mimic the fueling cycle for a hydrogen fuel cell vehicle.

Key Result

The robot will allow repeated, accelerated lifetime testing of the durability of hydrogen fueling hoses—currently a costly and frequently replaced component of hydrogen fueling infrastructure.

Potential Impact

Testing performed with the robot will reveal the hoses' durability over time in a real-world environment—helping bring down costs for the emerging hydrogen-fueled transportation market.

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

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