



## Houses built by robot? If scientist gets his way

By Lew Sichelman Special to The Times  
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WASHINGTON — By this time next year, a California scientist hopes to build a 500-square-foot "house" almost entirely by robot. If his experiment is successful, his next goal is to "print out" a complete one-story, 2,000-square-foot home in a single day with hardly any on-site help from human beings.

With federal funding, Behrokh Khoshnevis, a professor of industrial and systems engineering at USC, has devised a machine that takes its instructions from an architect's computerized drawings and then squirts successive layers of concrete, one on top of the other, to build vertical walls and domed roofs.

The computer-guided nozzle squeezes out a line of wet concrete like toothpaste being deposited on a toothbrush, according to a report from the NewScientist.com News Service. Then a pair of trowels attached to the nozzle shape the concrete as the robot repeats the pouring as many times as is necessary to achieve the programmed height.

Khoshnevis' "Contour Crafter" can work around the clock, with no need for breaks. It needs only power and a constant feed of semi-liquid building materials.

Khoshnevis' first robot-built house will be a shell. But he told Builder magazine recently that later efforts would include plumbing and electrical systems. Although a robot can't install doors or windows, the scientist told the publication that doing those jobs is so easy and fast it's not worth automating.

Initially, such robot-built structures would be used as emergency housing and as low-cost homes for inner cities and emerging nations. But the federal government is interested in them for military housing and possible space applications.

So far, Khoshnevis has tested his machine with cement, but he believes a mixture of mud and straw that is dried by the sun as it is deposited could be suitable. Degussa AG of Düsseldorf, Germany, the world's largest maker of building materials, is collaborating on the project to help find the best material.

Currently, the prototype machine hangs from a movable overhead gantry, much like a crane at shipping depots. The scientist says it's possible the robot could run along rails on the ground, spitting out several houses at a time. But it would be more difficult to create autonomous wheeled robots that have the same precision as more stationary machines.

Still, Khoshnevis thinks the technology might be used to create complex curving walls that are too difficult or costly to build by hand. And since robots may one day build houses for a quarter of today's cost, he believes that perhaps as soon as 2025, "all building will be done this way."