Robot team shifts into spider or snake on cue from 'hormone'
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A swarm of autonomous robots that can link together to slither, crawl and even roll around obstacles has been created by scientists in a project part funded by the US Department of Defense.

The machines are all identical yet can organise themselves into a variety of shapes and sizes using "digital hormones" to communicate with one another.

Wei-Min Shen, director of the polymorphic robotics laboratory at the University of Southern California, said they were designed to operate in difficult environments.

He hoped the approach could be used to develop robots that could search for and rescue people trapped in collapsed buildings or assemble themselves into multi-function space platforms.

Other tasks might include battlefield reconnaissance, a prospect that has attracted the backing of the Defense Advanced Research Project Agency.

Each robot contains a microprocessor and a power source. It is the size of a hand, can bend in two directions and crawl along at a slow pace.

But when the robots are linked together, they can move faster and more flexibly. They use infra-red signals to communicate and physically connect via docking modules on each of their four sides.

The 20 robots built by Professor Shen's team can take on snake-like forms to slither through narrow gaps, make tank-tread wheel shapes to roll down slopes, and spider-like configurations to walk up steps.

The way the robots organise themselves has been inspired by biology. In living organisms, cells communicate using chemical hormones. These affect different cells in different ways depending on their individual situations.

The robots similarly exchange signals that prompt responses that will vary with each element's position. For example, when the message to walk goes round the group, a robot making up the leg in the spider form might propel itself forward, while another in its body will remain rigid.

"You can easily reshuffle the modules," Professor Shen said. "We can literally take the legs off a 'spider' and plug them into the head and it becomes a 'snake'."
The team’s latest research will be presented at the international conference on complex systems in Boston next week.