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A Review of the Snake Robotic Research

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One of the most interesting animals among all creatures is the snake. The number of religious beliefs, myths, and legends illustrates man's fascination with snakes, and folktales associated with snakes. The Greek god Zeus was thought often to assume the form of a serpent when he visited earthly beings. In China and Germany snakes were believed to control the lakes, the springs, and the rains. To the ancient Egyptians Uraeus, the cobra is a supreme divine being and represents royal wisdom and power. Indians believed the cobra to be a mount of Vishnu and as such represents knowledge, wisdom and eternity. For Incas the serpent and bird are the beneficent aspect of Quetzalcoatl. Persian people believed the snake to be an aspect of Ahriman or Angra Mainu, the serpent of Darkness, the Liar. The Persian snake Azi-kahak is the throttler, enemy of the sun god.

Recently, many researchers have shown interest in this creature because of its flexibility. A mechanical snake (snake robot) is suitable for the following applications: inspection and minor repair of hard to reach areas in aircraft, factories, nuclear reactor interiors, utility tunnels and inside pipes. Other applications include active fire-fighting hoses; and by miniaturization, it could even be used as a medical device such as an active endoscope or other internal medical device. It could maneuver through rubble to look for survivors after an earthquake. As a mechanical device despite the frictional disadvantages caused by crawling, the snake's mobile body has special characteristics, making it suitable in most terrains. Its slender body is kinematically stable and creeping behavior is suitable for moving over uneven, rough, and irregular terrain. The distribution of weight enables the snake to propel itself over soft surfaces. From an engineering point view of its modular construction, the snake has a high level of redundancy. This characteristic enables the snake to pass through obstacles; also, replacement of broken sections is easily performed.

This presentation encompasses the design and construction of an snake robot, capable of sliding on the ground, raising its head, climbing pipe and performing motions in 3D space. The robot has a modular construction equipped with pressure sensors to sense the contact points with obstacles. Serpentine movement is the mode the robot uses to move on the ground. To climb a pipe it will take advantage of concertina movement. In this research the attempt is: obtaining the maximum speed for rectilinear motion, modifying the known serpentine equation and developing a formulation of concertina motion.