Health Monitoring and Inspection of Buried Pipes

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Abstract

Force mains are underground pipes that carry wastewater from collection point to treatment plant and are subjected to various hydraulic and structural loads. These pipes are typically buried 4 feet under ground and are only accessible at entry and exit points. These pipes are typically from couple hundred to couple of thousand feet and have a down time of less than 6 hours. In order to carry out an effective health monitoring of these pipes through regular inspection, an ultrasonic crawler, based on the concept of crawling of snake, through a pipe has been developed in partnership with Inspector Systems of Germany. The system has the flexibility of a snake to crawl through difficult to navigate bends in pipes. However, challenges for actual applications are numerous and significant:

- (i) The crawler needs power supply to navigate through pipes. This becomes a challenge for very long pipes of lengths longer than 4000 feet because of the weight of cable, data transmission difficulties, etc.
- (ii) Current sensing is through water coupled ultrasonic. This causes serious challenges of maintaining thousands of feet long pipes flooded for several hours during inspection. Recent advances in air-coupled ultrasonic sensing offers significant potential in this area.

Successful development of this type of system is becoming a necessity given the age of buried pipes under cities around the world. Successful development of this technology present a grand challenge and will lead to smart buried infrastructure across the world.







Ultrasonic Crawler through a small entrance

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Dr. Anil K. Agrawal is a professor of Civil Engineering at the City College of the City University of New York. He received his B.Tech. in Civil Engineering from the Indian Institute of Technology, Kanpur in 1988, M.S. in Earthquake Engineering from the University of Tokyo, Japan, in 1991, Ph.D. degree from the University of California, Irvine, in 1997 and joined the City College of New York in September 1998. Prior to joining the City College of New York, he worked as a post-doctoral researcher at the University of California, Irvine during August 1997 to August 1998. He has published more than 45 Journal papers and more than 100 conference papers. He is currently the member of executive committee of U.S. Panel of International Association of Structural Control and Health Monitoring, Chair of the ASCE Committee on Structural Control, vice-

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