Development of a Pipe Crawler Inspection Tool for Fossil Energy Power Plants

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Fossil fuel power plants are complex systems containing multiple components that create extreme environments for the purpose of extracting usable energy. Failures in the system can lead to increased down time for the plant, reduction of power and significant cost for repairs. In the past, inspections and maintenance of the plant's superheater tubes has been predominantly manual, laborious, and extremely time consuming. This is due to the pipe's small diameter size (between 1.3 and 7.6 cm) and the coiled structure of the tubing. In addition, the tubes are often stacked close to each other, limiting access for external inspection. Detection of pipe degradation, such as increased levels of corrosion, creep, and the formation of micro-cracks is possible using standard non-destructive evaluation (NDE) methods, including ultrasonic, radiography and electromagnetic methods. However, when the access to the sub-systems is limited or the configuration of the structure is prohibitive, alternative methods are needed for deploying the NDE tools. This research effort considers a novel robotic inspection system for the evaluation of small pipes found in typical boiler superheaters that have limited access. The pipe crawler system is an internal inspection device that can potentially navigate through the entire pipe length using linear actuators to grip the walls and inch along the pipe. The modular nature of the system allows it to traverse through straight sections and multiple 90-degree and 180-degree bends. The crawler is also capable of providing visual inspections, ultrasonic thickness measurements, and generating inner diameter surface maps using LiDAR (light detection and ranging). Ultimately, the development of this robotic inspection tool can provide information regarding the structural integrity of key pipeline components in fossil fuel power plants that are not easily accessible.