

Case ID:M19-212P^

Published: 12/6/2022

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## Bio-Inspired Robot for Tube Inspection

-Tubular structures are commonly used in boilers and heat exchangers. Working under extreme conditions such as high temperatures, large stress loads, hot and high-velocity steam and pressure leads to corrosion, cracks, and stress-corrosion cracks in either the body or welded connections of these components. Regular inspection of these components is vital to avoid tube leakages. This task can be challenging, time-consuming and in many cases, impossible. Using robots for inspection is a promising solution to these challenges. Typical robotic systems show limitation in interacting with complex environments; however, bio-inspired robotics systems have proven helpful in overcoming these limitations.

Researchers at Arizona State University and at New Mexico State University have developed a bio-inspired robotic device for detection and evaluation of crack and corrosion defects in tubes. The robotic device includes a pair of gripper blocks, each gripper block including a motor and a plurality of toes. Each of the plurality of toes includes a network of couplant-free ultrasound transducers for non-destructive testing of surfaces. In addition, each toe includes frictional pads that can be used for effective climbing of tubes or other surfaces. The pair of gripper blocks can be linked by a bendable "backbone" which is capable of elongation to allow the robot to maneuver along pipes and surfaces. The robotic device may also include a tail equipped with various transducers for further examination of tube surfaces.

Issued U.S. Pat. No. [11,504,854](#)

### Potential Applications

- Non-destructive testing (NDT) and inspection of tubular structures (e.g., in power plants, petroleum oil and gas industry, chemical processing plants, etc.)

### Benefits and Advantages

- Maneuverable on 90- and 180-degree elbows
- Able to pass over flanges, climb boiler walls, traverse different types of tubes regardless of tube material (e.g., non-ferromagnetic or ferromagnetic) and/or tube surface conditions (e.g., corroded, rough, complex geometries, etc.)
- Image/inspect tube while robot is stationary or moving

