Pipe Measurement Robot

Kikuhito Kawasue, Unversity of MIYAZAKI

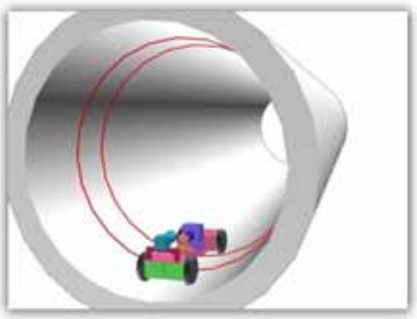
In Japan, sewer pipes over 320,000 kilometers in total are existed under ground. Some data shows that numbers of sewer pipe will be worn by 2010 and it has a possibility to cause the sinking of the ground. Since 80 percent of these pipes have a size of 45 centimeters or less in the diameter, human inspector can not enter into these pipes by himself. Recently, the inspection of the pipe is executed by the moving cart with CCD camera. Currently human inspector judges the situation of the pipe by the images recorded by the moving cart. It should to be noticed the judgment by the human causes the individual variation since it depends on the person's sense. Quantitative measurement is required.

In order to cope with this problem, we have developed the robot equipped with two parallel lasers and CCD camera. Quantitatively and speediness measurement can be executed using this system.

Measurement Robot

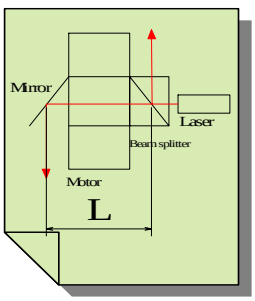
System

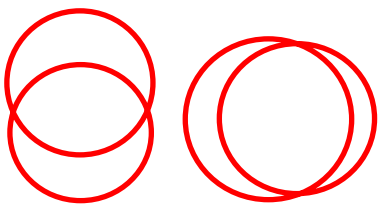
- The robot equipped with two parallel lasers and CCD camera runs along the inside of the sewer pipe and measures the shape of the pipe.
- The laser is projected in the normal direction from the axis of the pipe.
- The laser is rotated by the motor and the laser draws the annular streak on the surface.
- The shape of the streak is varied by the surface condition and deformation of the pipe.
- The computer processes the image of the streak and checks the condition of the pipe.
- The average error is under 0.1 mm and the results are shown graphically on the computer display.



System

- Parallel lasers are projected on the surface of the pipe
- The computer analyzes the image and convert image to the 3D shape data

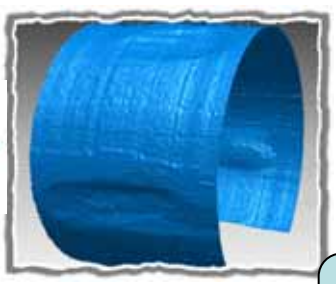




Detection of the direction of the pipe axis using parallel laser

- The direction of the axis of the pipe can be known by the deviation between these two annular streaks.

Computer Processing



Result of measurement

- The 3D shape can be reconstructed by summarizes the measured data
- Thickness of the pipe can be measured by adjusting the center to the outside of one.

Please feel free to contact
kawasue@cc.miyazaki-u.ac.jp