## Composite Storage Tank Monitoring Using A Time-Differential Fiber Optic Bocda Sensor

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For the safe maintenance of composite storage tanks, we developed fiber optic sensing and monitoring technic to detect the local stiffness degradation and damages by measuring the distributed strain during regular inspection (once a year or once every 6 months). As the first work, we developed a random code phase modulation time difference controlled fiber optic BOCDA sensor system for distributed strain measurement. This sensor system can measure strain at 5 cm intervals when using a 500 m sensing fiber. In particular, the user can select the measuring points to optimize the monitoring and the overall measuring time. In this system, it is 20 msec to measure the strain value of one measuring point, so the total measurement time can be determined as the product of the total measurement points and the measurement time of one point. Additionally, strain measurement accuracy is approximately 5 micro strains (standard deviation) at 5 averaging numbers. An application study was conducted for damage monitoring of an industrial plant process water storage composite tank using this fiber optic BOCDA sensor system. A sensing fiber was attached on the outer surface of the tank for 3 turns to monitor changes in strain due to local stiffness degradation and some damages. As a result of installing it on the actual site and measuring it for over 8 months, it was confirmed that the strain stability within  $\pm 200$  micro strain is normal. Also, we studied by using a damage simulation tank, it was confirmed that the distributed strain change due to local damage could be detected by measuring the distributed strain in this tank. Therefore, this distributed strain monitoring technique can be used to monitor the condition of large storage tank structures.