Temperature compensated strain monitoring of composite storage tank based on time-differential Brillouin optical correlation domain analysis

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In this study, correction for temperature changes was performed to measure the deformation of an externally installed composite storage tank using TD-BOCDA. The fiber-optic distributed sensor utilizing Brillouin scattered light is driven by simultaneously measuring temperature and strain. Due to the characteristics of this driving method, there is a disadvantage that it is difficult to measure the deformation of an object whose temperature changes. To overcome these shortcomings, research has been conducted to measure temperature separately. The existing method was performed by measuring the approximate temperature using a distributed temperature sensor (DTS) or a point temperature sensor. However, in the case of a point sensor, it is impossible to perform accurate temperature measurement due to the dark area, and in the case of DTS, although there is no dark area, the accurate temperature of the measurement point cannot be measured due to the difference in spatial resolution. In order to overcome these shortcomings, a self-referencing method was used to measure temperature and strain simultaneously using the same sensor, and a measurement method was used to measure only temperature. For this purpose, a structure was designed using silicone rubber. Using this silicone rubber structure to block external influences, the temperature measurement optical fiber is placed close to the strain measurement optical fiber, and then only the strain applied to the structure is determined using the measured values of the two optical fibers.