

## ABSTRACT

Structural Health Monitoring (SHM) is monitoring the safety condition of a building structure which is also carried out on bridge infrastructure. SHM is done to find the damage as early as possible so that it can be handled immediately and avoid unwanted events. One of the SHM methods that can be carried out in monitoring the condition of the bridge is non-contact detection, which in this study will be carried out by detecting a small displacement profile using the Radar Frequency Modulation Continuous Wave (FMCW) system.

The FMCW radar is a particular radar sensor that emits a continuous transmission signal that can change its operating frequency during measurement. FMCW radar is considered more suitable for use in this study because it can detect small displacement profiles with less power and reduce spectrum usage, making it easier to realize. This study focuses on developing a small displacement profile detection method on bridges for SHM using FMCW radar at a frequency of 24 GHz.

Methods for obtaining displacement distribution profiles are through simulation processes, laboratory experiments, and testing in relevant environments. Through the simulation process, good results were obtained with an error of  $3.8 \times 10^{-4}$ . Furthermore, in laboratory experiments, single-point detection obtained an error of 0.098 millimeters and multi-point detection obtained an error of 0.058 millimeters. Based on the multi-point data, the displacement distribution profile of the bridge is well known. The error is minimal because in this study statistical analysis or processing is also carried out to reduce noise. This study also tested the tool for use in relevant environments for single point detection with dynamic data. The result is that the tool can detect the movement on the bridge well and the results obtained can also meet the existing requirements.

**Keywords:** SHM, FMCW, bridges, *multi-point*