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Abstract

Microwave Sensors to Monitor the Displacement of Civil Structures: Recent Experimental Campaigns and Last Issues towards Advanced Sensors †

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Using interferometric processing, a coherent radar is capable of detecting the displacement of structures with submillimetre accuracy and from large ranges, with the limitation that only the component along the line of sight can be measured. Many papers have been published focused on the ambient vibration test of bridges, cables, wind turbines, towers, and buildings. Although the development of interferometric radar sensors for the monitoring of civil engineering structures dates back to the 1990s, and the effectiveness of the working principle has already been consolidated, the study of advanced sensors is progressing slowly. Recently, some papers proposed novel sensors, aiming not only at improving performances and capabilities of interferometric radar, but also at proposing instrumentation with reduced costs. A few innovative systems have been tested but not yet definitely commercialized, and expected improvements have only been achieved in theoretical or trivial examples.

In this presentation, the authors summarize, with experimental examples, the main technical features of the available radar sensors, and how they are linked to the final performances of the dynamic measurements. Main performances are dictated by radar parameters as the swept bandwidth or the achievable SNR, which affect the range resolution, i.e., the capability to distinguish two different targets or parts of a surface, and the available accuracy respectively. We also discuss the possible improvements achievable using an updated technology. The development of advanced systems able to provide an optimum configuration of the proposed technology demands a strong interaction with the user communities. Finally, we also introduce a novel sensor working at a higher frequency, able to provide some improved performances presently under development at CTTC.

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