FASTGBSAR-R

MetaSensing's FastGBSAR-R is a ground based radar solution for monitoring unstable natural elements and critical artificial structures. Using RAR (Real Aperture Radar) technology, the FastGBSAR-R is particularly suitable for static and dynamic structural monitoring of man-made structures such as bridges, towers, buildings, pillars, wind turbines.

Easily transportable and designed to work in all weather conditions, the FastGBSAR-R can quickly be installed on a tripod. In a few minutes the user can obtain displacement profiles along the complete structure with an accuracy of 0.01 mm.

Telecom tower

Wind turbines

Bridge

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Figure 1: FastGBSAR installation for monitoring a railway bridge.

Figure 2: Railway bridge under observation.

Monitoring a railway bridge

The fixed installation of the FastGBSAR-R on a tripod (Fig. 1), allows for simultaneous measurement of deformations of different spans of the bridge (Fig. 2), and gives the complete picture of the dynamic response of the bridge while trains cross over it.
Figure 3 shows the displacement time series for each span during the transit of the train.

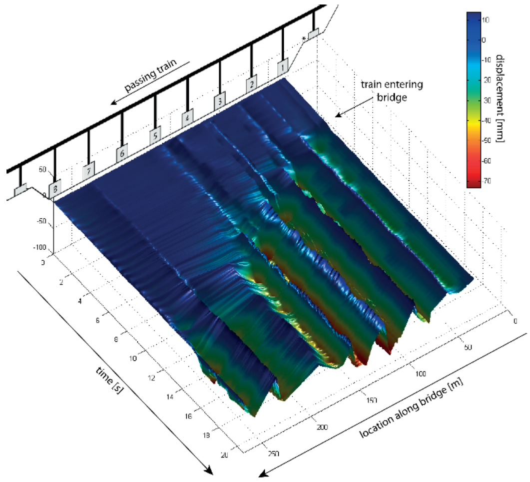

Figure 3: Displacement map under the load of a passing train.

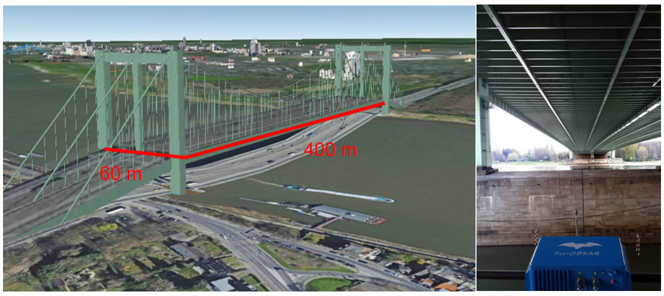

Figure 4: Highway bridge under observation.

Monitoring a highway bridge

A mode shape is the vibration pattern of a structure seen at one particular frequency. It only varies according to the structure's mechanical and thermal properties, and does not depend on the exciting force.

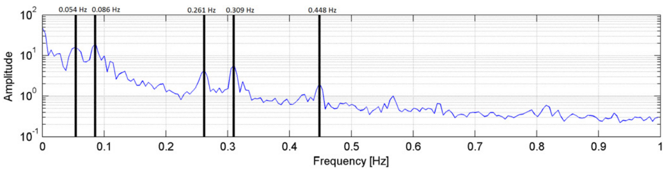

Figure 5: Vibration frequency analysis. The black lines represent the frequencies corresponding to the mode shapes shown in Fig. 6.

The simultaneous observation of many points along the bridge is particularly useful for the determination of the mode shapes.
Figure 6 shows the mode shapes of a 400 m long cable-stayed highway bridge (Fig.4), corresponding to the frequencies marked in Fig. 5.

Multiple measurements acquired with different viewing angles make it possible to distinguish between vertical, torsional and horizontal modes.

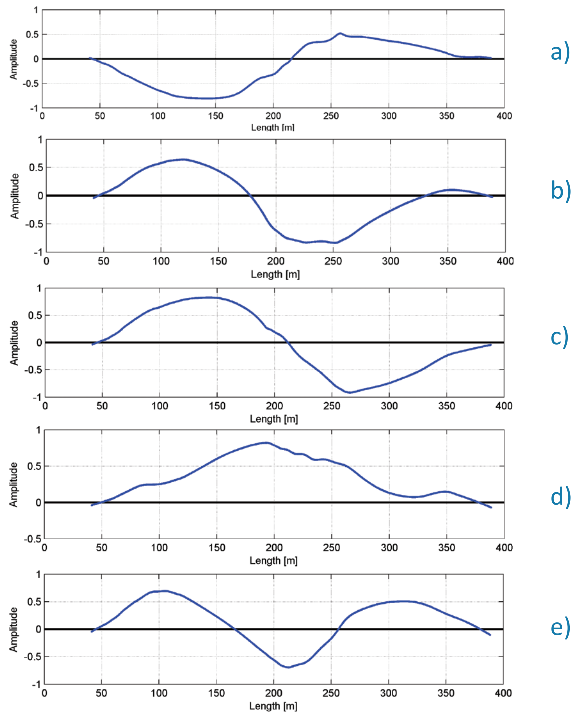

Figure 6. Mode shapes at a) 0.0054 Hz, b) 0.086 Hz, c) 0.261 Hz, d) 0.309 Hz, e) 0.448 Hz

Monitoring a telecommunication tower with the polarimetric FastGBSAR

A 42 meter high telecommunication tower (Fig. 8) was monitored in moderate to low wind conditions. The measurements were performed with the polarimetric FastGBSAR-R, equipped with four antennas to increase sensitivity to different scattering mechanisms.

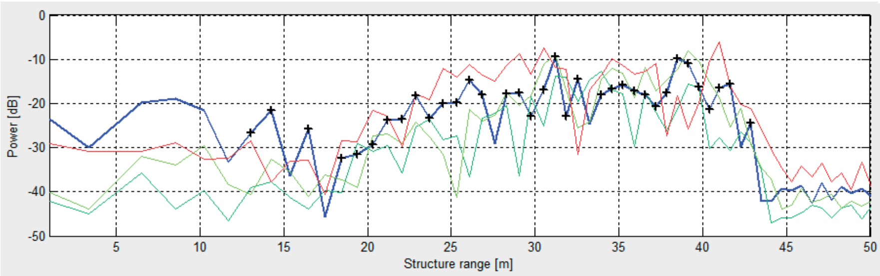

Figure 7: Power profile along the tower for each polarimetric channel. The black crosses indicate the points selected for further analysis.

Figure 8: Telecommunication tower

Figure 9 shows the oscillation of the tower during 10 seconds of acquisition for three selected points (a-b-c) at different heights. The sub-millimeter horizontal displacement can clearly be seen.

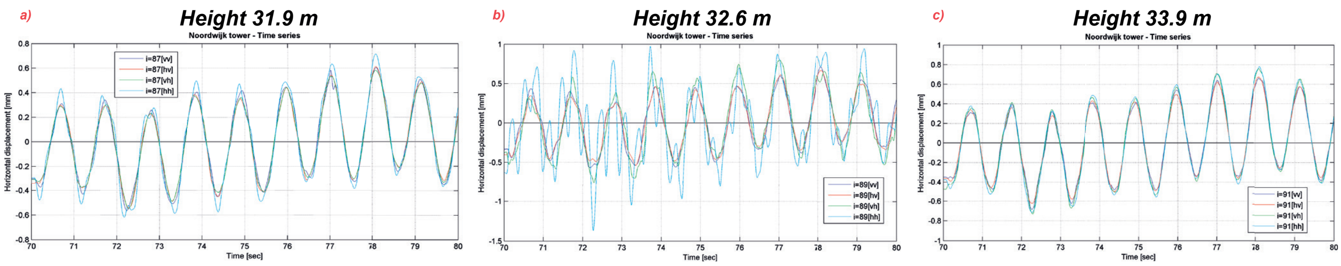

Figure 9: Time series of the tower's horizontal displacement for selected points at different heights.

Monitoring wind turbines

Determining the vibration and modal parameters of wind turbines can assist in the optimization of their design and performance. The knowledge of the eigenfrequencies of the tower and rotor blades is essential to prevent structural failure. Figure 11 shows the simultaneous monitoring of two wind turbines located at different distances. The location of the wind turbines can be identified by the peak in the backscattered power, and by the SNR drop, which is due to the movement of the rotor blades.

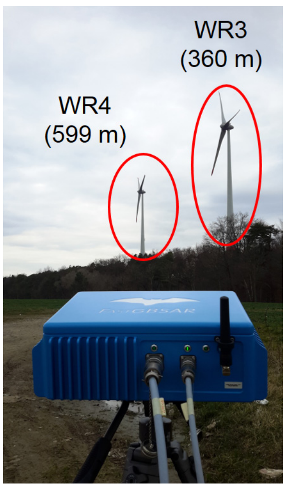

Figure 10: FastGBSAR installation for monitoring wind turbines.

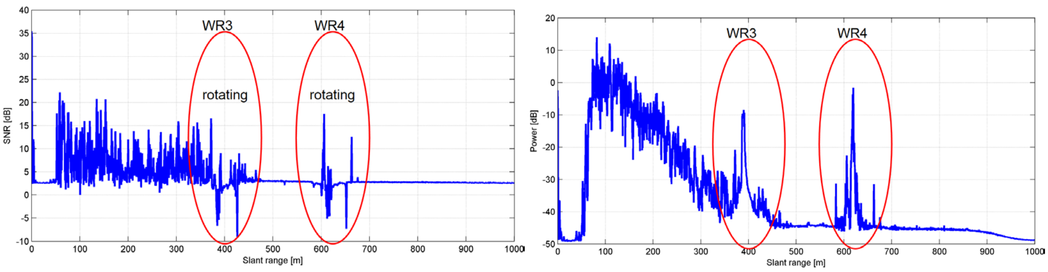

Figure 11: Backscattered power profile (left) and Signal to Noise Ratio (SNR) profile (right).

METASENSING FastGBSAR-R	
Operating frequency	17.2 GHz (Ku Band)
Range resolution [1]	Up to to 0.5 m
Maximum range	4 km
EIRP Power	19 to 42 dBm
Operating temperature range	-25˚C to 60˚C
Environment	IP65
Sensor weight	12 KG
Accuracy	± 0.01 mm
Acquisition time	0.25ms
Power consumption	70 W

FastGBSAR-R installed on a tripod.

Front view of the FastGBSAR-R, standard (top) and polarimetric (bottom) versions.

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