

Data from bistatic radar observation

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1. A measurement using bistatic radar

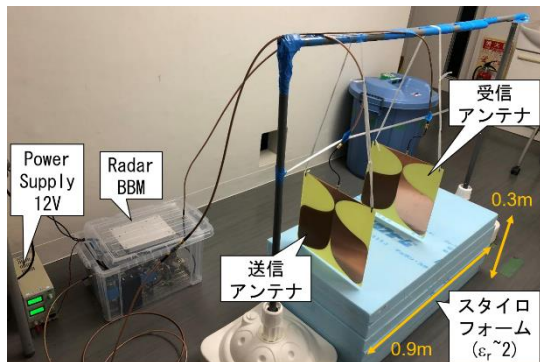


Fig.1: Photo of measurement experiment

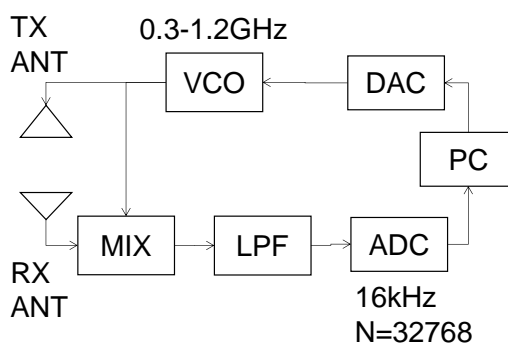


Fig.2: Block diagram of the radar

Parameters of measurements and instrument are as follows:

[Antenna locations]

Horizontal interval of antenna locations (1, 2, ..., 5): 0.2 m

TX antenna location: 5 (fixed)

RX antenna location: 1-4 (changed)

[VCO&DAC]

Bandwidth of chirp: 0.3-1.2 GHz

Pulse duration: 1 s

[ADC&PC]

Sampling frequency: 16 kHz

Sampling number: 32768

Output: CSV files

Col. 1: Time [s]

Col. 2: Voltage applied to VCO [V]

Col. 3: IF output [V]

2. Suggestions for the analyses

Ex-1. Estimate the permittivity of the Styloform.

Ex-2. Estimate the depth of the boundary between the Styloform and floor.

You can determine RMS velocity V_{RMS}^2 and vertical delay τ_n up to the bottom of the n-th subsurface

layer from the peaks of cross correlation function $F(V_{RMS}^2, \tau)$:

$$F(V_{RMS}^2, \tau) = \sum_{i \neq j} f_i \left(\sqrt{\tau^2 + \frac{L_i^2}{V_{RMS}^2}} \right) \cdot f_j \left(\sqrt{\tau^2 + \frac{L_j^2}{V_{RMS}^2}} \right), \quad (1)$$

where f_i and f_j are A-scan obtained from different combinations of TX and RX antenna locations, L_i and L_j are horizontal distance between TX and RX antenna locations.

After V_{RMS}^2 and τ_n , are determined, velocity V_n within n-th subsurface layer n can be derived using Dix formula as

$$V_n = \sqrt{\frac{\tau_n V_{RMS,n}^2 - \tau_{n-1} V_{RMS,n-1}^2}{\tau_n - \tau_{n-1}}} \quad (2)$$

[Hint]

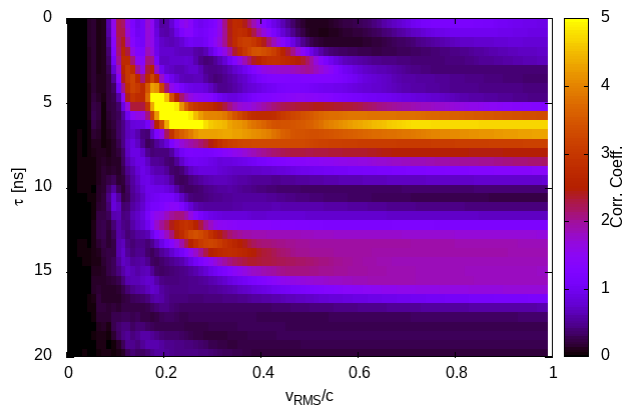


Fig.3: $F(V_{RMS}^2, \tau)$