M-Sequence UWB Radar for Industrial Applications

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Ultra Wideband Radar has the potential of dramatically improving the control and surveillance of industrial processes in confined areas. An example is the application of UWB radar for surveillance of furnaces for heath treatment of steel billets developed by Radarbolaget in Gävle.

In our installation at AB Sandvik Materials Technology, we have shown that by using a non-destructive UWB Radar technique it is possible to visualize in real-time the ongoing process inside the furnace behind a 0.5 m thick ceramic wall. Since the operating temperature inside the furnace is 1200 °C, there is today no other known method capable of visualizing the process for the operator of the furnace. The system is therefore designed to sustain high temperatures and powerful electromagnetic disturbances while performing measurement with wide dynamics and high stability.

The design of this radar is based on the idea of transmitting a continuous m-sequence and then detecting the correlated impulse response (see figure below). The wide bandwidth is a requirement for obtaining high spatial accuracy and resolution but puts further requirements on the design of the antennas and the electronics. Our results show that with this technique it is possible to determine the deformation of the steel billets inside the furnace with an accuracy of less than 5 mm. The radar system is also able to detect deformations in the furnace wall

The m-sequence radar has many advantages over other UWB radar technologies since it e.g. does not require many analogue components. Its performance is a result of the choice of code length, sampling rate and averaging. However, the resolution is still limited by the impulse response of the analogue antenna (ringing).

In this paper system parameters that affect the overall performance of an m-sequence radar are reviewed and means of enhancing its performance are discussed.

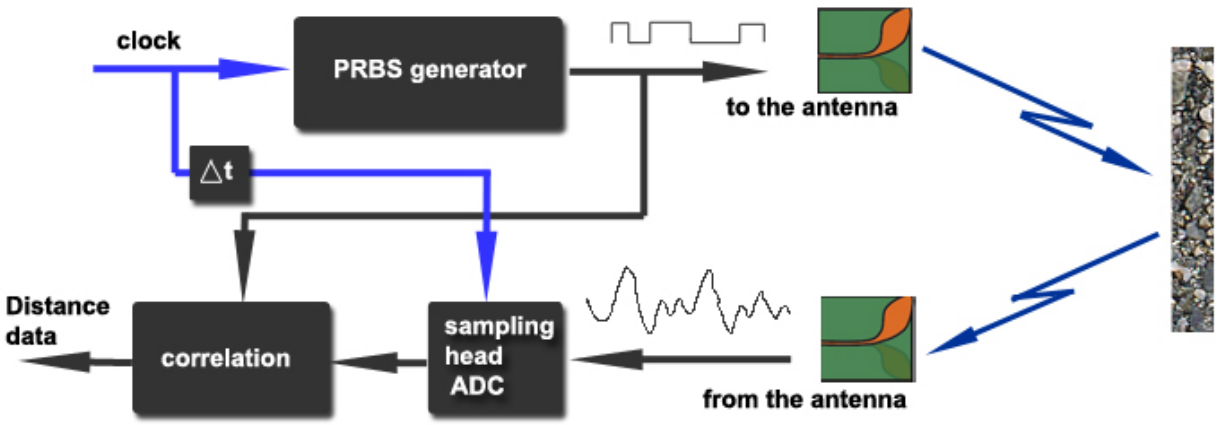

Fig. Schematic illustration of an m-sequence UWB radar