

**Abstract:**

The performance offered by many applications based on low-cost devices are often limited by the following characteristics of the available data acquisition system: (i) maximum sampling rate, (ii) effective number of bits, and (iii) acquisition memory depth and (iv) sequential acquisition scheme.

To overcome the problem of the limited sample rate, traditional approaches are based on equivalent time sampling, either synchronous or random, or alternatively on band-pass sampling. However, these acquisition modes require strict constraints in order to properly reconstruct the input signal and/or avoid aliasing. With regard to the vertical resolution, typical solutions, referred to as HiRes or enhanced resolution, are mainly based on a preliminary signal oversampling and a successive filtering (either low pass or band-pass) and decimation stages. Unfortunately, the oversampling approach requires acquisition units characterized by a data memory depth largely oversized for the number of samples produced by the decimation filter.

Starting from their long experience on data acquisition devices, the speakers aim at presenting how innovative sampling strategies, based on a suitable integration of Compressive Sampling paradigm and digital signal processing, are able to overcome the abovementioned limitations, thus allowing the simultaneous increase of the maximum sample rate and vertical resolution of traditional ADCs. Moreover, thanks to a suitable acquisition and reconstruction scheme, synchronous multi-channel digitization can be carried out also on traditionally sequential devices.

Finally, the promising results in reducing the experimental burden of the application of CS approaches to early crack detection in avionics applications will be given.