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High resolution systems: the resolution problem

Yan Pailhas, Yvan Petillot

Abstract: Resolution comes from the Latin word *resolvo*, which literally means “untie a knot”. The meaning evolved, in optics, toward the capability to distinguish two scattering points. For the MCM (Mine Counter Measure) problem, the introduction of synthetic aperture systems, and the resulting drastic increase in resolution, has been a game changer, as the useful information shifts from shadows to highlights. If SAS resolution has been well studied, new SAS reacquisition patterns have emerged, in particular circular acquisitions known as CSAS. In this talk, we will derive the theoretical resolution of such systems based on a PSF (point spread function) energy leakage interpretation rather than the traditional Rayleigh resolution criteria. We will compare the CSAS resolution capability with the newly developed MIMO paradigm. The statistical framework of MIMO systems greatly differs from the deterministic approach of synthetic aperture systems, and offers certain advantages in term of resolution. All these coherent systems approach the imaging problem without any priors, other than the presence of scatterers. Going back to the original meaning of *resolvo* however, we will show that, by introducing priors such as target shape, wideband sonars shift the analysis into the phase domain and are able to outperform imagery.

Keywords: SAS; CSAS; MIMO.

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