GLOSSARY

Absolute phase: Common complex phase term of all the entries of a general $m \times n$ complex matrix.

Antenna aperture: The equivalent area from which an antenna directed towards the source of the received signal gathers or absorbs the energy of an incident electromagnetic wave.

Antenna gain: Measures the power amplification factor of the antenna.

ASAR: Acronym of Advanced Synthetic Aperture Radar.

Basis: In the particular case of a vector space, a basis consists of a set of vectors, the combination of which is able to span the complete space. A vector basis is not unique. In an orthogonal basis, all the basis elements are orthogonal. In a orthonormal basis, all the basis elements are orthogonal and with magnitude equal to 1.

Backscatter alignment (BSA): In a scattering problem, BSA refers to a configuration in which the coordinate systems of reference, for the transmitting and receiving antennas, are established respect to the antenna polarization. In the backscattering case, the coordinate systems for the transmitting and the receiving system are equal.

Backscattering: In a scattering problem, backscattering direction refers to the opposite direction of the incident wave. A backscattering configuration refers to those situations in which the transmitting and receiving systems are collocated.

Bistatic: A bistatic configuration refers to those situations in which the transmitting and receiving systems are not collocated.

Boxcar filter: Spatial filtering consisting of the average of a certain quantity over a given number of pixels.

Canonical polarization state: Polarization states for which the parameters of the polarization state take special values. The most important canonical polarizations states are: horizontal and vertical polarizations and left and right circular polarizations.

Canonical scattering mechanism: A canonical scattering mechanism refers to those mechanisms presenting well defined scattering properties, mainly due to their simplicity.

Classification: Signal processing technique aiming to cluster the image pixels which present common characteristics.

Coherent addition: Addition of complex quantities.

Coherent decomposition: Any decomposition of the scattering matrix [*S*] into simpler scattering mechanisms.

Complex scattering amplitude: Without considering the propagation effects, the complex scattering amplitude refers to the quotient between the scattered and the incident fields.

Complex scattering coefficient: The same as complex scattering amplitude.

Con-similarity: Refers to the way a scattering matrix [*S*] transforms under a change of polarization basis.

Copol max: Polarization state giving maximum received power when the transmitting and receiving systems employ the same polarization state for the antennas.

Copol nulls: Polarization state giving zero received power when the transmitting and receiving systems employ the same polarization state for the antennas.

Co-polar: Refers to those situations in which we consider the incident and the scattered electromagnetic waves with the same polarization state.

Correlation coefficient: Magnitude of the complex correlation coefficient of a pair of complex SAR images.

Cross-polar: Refers to those situations in which we consider the incident and the scattered electromagnetic waves with orthogonal polarization states.

Distributed scatterer: Refers to a scatterer which area is larger than the radar coverage.

Eigendecomposition: It also receives the name of "matrix diagonalization". For a square matrix, it consists of the transformation giving as a result a diagonal matrix. The elements of the resulting diagonal matrix are called eigen values, whereas the columns of the matrix performing the transformation are called eigenvectors.

Electromagnetic wave: Radiation of energy in the form of transverse waves, produced by moving charges.

Ellipse amplitude: Given the polarization ellipse, the ellipse amplitude consists of the amplitude formed with the semimajor and the semiminor axes of the ellipse.

Ellipse aperture: Given the polarization ellipse, the ellipse aperture is defined as the angle formed by the semimajor and the semiminor axes of the ellipse.

Ellipse handedness: Given the polarization ellipse, the ellipse handedness consists of the sense of rotation of the vector describing the polarization itself, respect to the sense of propagation of the electromagnetic wave.

Ellipse orientation: Given the polarization ellipse, the ellipse orientation is the angle formed between the horizontal axis of reference and the semimajor axis of the ellipse.

Equivalent number of looks (ENL): A quantity employed to describe the statistics of the speckle noise. The higher its value, the lower the variance of speckle noise.

Far field: The region where the angular field distribution is essentially independent of distance from the source.

Forward scattering alignment: In a scattering problem, FSA refers to a configuration in which the coordinate systems of reference, for the transmitting and receiving antennas, are established respect to the traveling wave.

Fully polarimetry: It refers to those situations in which the polarimetric system measures all the entries of the scattering matrix [*S*].

Fully polarized wave: An electromagnetic wave whose polarimetric ellipse parameters are constant in time.

Homogeneous area: Image area whose statistical moments, mean and variance, are constant for all the pixels.

Homomorphism: A term used in category theory to mean a general morphism. The term derives from the Greek (omo) "alike" and (morphosis), "to form" or "to shape."

Incident wave: In a scattering problem, it refers to the incoming wave sent by the transmitting system.

Incoherent decomposition: Any decomposition of the second order descriptors: covariance, coherency of Müeller matrices, into simpler scattering mechanisms.

Isotropic scatterer: A hypothetical scatterer that radiates or receives equally in all directions.

Jones vector: Complex bidimensional vector employed to describe the polarization of an electromagnetic wave. It contains all the polarization information except the polarization handedness as it does not contain propagation information.

Matrix rank: The number of independent rows or columns of a matrix.

Monostatic: Same as backscattering.

Monochromatic plane wave: A particular electromagnetic wave radiation characterized by a single frequency and for which the equiphase points are contained in a plane perpendicular to the direction of propagation of the electromagnetic wave.

Multiplicative speckle noise model: Noise model which describes the information contained in a homogeneous area as the product of a constant by an exponentially distributed random variable of mean and variances equal to one. This random variable represents the speckle noise component.

Orthogonality: In elementary geometry, the same as perpendicular. In the case of a space vector, two elements v and w are said orthogonal if their inner product equals zero.

Partial polarimetry: It refers to those situations in which the polarimetric system does not measure all the entries of the scattering matrix [*S*].

Partially polarized wave: An electromagnetic wave whose polarimetric ellipse parameters are not constant in time. Consequently, this type of waves can not be represented by the Jones vector.

Plane wave: A wave whose surfaces of constant phase are infinite parallel planes normal to the direction of propagation.

Polarization ellipse: Mathematical figure described by the electromagnetic field vector in an equi-phase plane. This plane is perpendicular to the direction of propagation of the wave.

Poincaré sphere: Graphical representation of Stokes vector in by means of a sphere.

Point scatterer: Refers to a scatterer which area is smaller than the radar coverage.

Polarimetric invariable: A quantity which does not depend on polarization.

Polarization basis: A polarization basis consists of a pair of two orthogonal Jones vectors in which any particular Jones vector, describing a particular polarization state, can be expressed.

Polarization fork: As established by Huynen, the polarization fork consists of the locus of the characteristic polarimetric states Copol max, copoll nulls and Xpol, nulls.

Polarization ratio: It consists of the quotient of the two entries of a Jones vector.

Polarization state: A different form to call the polarization of an electromagnetic wave.

Propagation of a wave: Evolution in time and space of an electromagnetic wave.

Pure target: Refers to a scatterer which area is smaller than the radar coverage.

Radar Cross Section: An expression of the extent to which an object, i.e., a target, reflects radar pulses, usually with respect to their point of origin.

Reciprocity: Electromagnetic property imposing the off-diagonal elements of the scattering matrix to the equal.

Roll-invariant: Target property which does not varies for rotations of the target along the line of sight.

Scattered wave: In a scattering problem, it refers to the scattered wave transmitted by the target.

Segmentation: Signal processing technique aiming to divide the image pixels which present common characteristics.

Span: Power received by a fully polarimetric systems. It consists of the addition of the intensity of the four elements of the scattering matrix.

Special unitary complex matrices group SU(2): The group of 2×2 unitary matrices, with determinant equal to +1. The matrices of this group are characterized by 3 independent parameters.

Speckle: Statistical variation associated with SAR imagery and caused by the coherent nature of the imaging process.

Stokes vector: Four dimensional real vector able to represent the polarization state of an electromagnetic wave.

Supervised classification: Classification based on the external help of the user. This classification scheme is not automatic.

Symmetric scatterer: A scattering is considered symmetric when the target has an axis of symmetry in the plane orthogonal to the direction between the radar and the target.

Unsupervised classification: Classification without any external help of the user. This classification scheme is considered fully automatic.

Volume scattering: Scattering mechanism produced in a cloud of particles.

Wave polarization: Vectorial nature of a monochromatic plane electromagnetic wave.

Wave vector: Vector whose magnitude is the wave number k and the orientation give by the direction of propagation of the electromagnetic wave.

Xpol max: Polarization state giving maximum received power when the transmitting and receiving systems employ orthogonal polarization states for the transmitting and receiving antennas, respectively.

Xpol null: Polarization state giving zero received power when the transmitting and receiving systems employ orthogonal polarization states for the transmitting and receiving antennas, respectively.

Xpol saddle: Polarization state giving minimum received power when the transmitting and receiving systems employ orthogonal polarization states for the transmitting and receiving antennas, respectively.