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Description Fundamental formulas for Radar, for attenuation, range, velocity, effectiveness, power, scatter, doppler, geometry, radar equations, etc. Based on Nick Guy's Python package PyRadarMet

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Author Jose' Gama [aut, cre], Nick Guy [aut]

Maintainer Jose' Gama <rxprtgame@gmail.com>

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ApertureWeightingFunctionsAntenna

Antenna Characteristics for Aperture Weighting Functions

Description

ApertureWeightingFunctionsAntenna has Antenna Characteristics for Aperture Weighting Functions

Usage

ApertureWeightingFunctionsAntenna

Author(s)

Jose Gama

Source

G. Richard Curry, 2011 SciTech Publishing Radar Essentials, A Concise Handbook for Radar Design and Performance Analysis

References

G. Richard Curry, 2011 SciTech Publishing Radar Essentials, A Concise Handbook for Radar Design and Performance Analysis

Examples

```
data(ApertureWeightingFunctionsAntenna)
str(ApertureWeightingFunctionsAntenna)
```

AttenuationAbsCoeff *Absorption coefficient of a spherical particle*

Description

AttenuationAbsCoeff Absorption coefficient of a spherical particle. From Doviak and Zrnic (1993), Eqn 3.14a or Battan (1973), Eqn 6.6

Usage

```
AttenuationAbsCoeff(D, lam, m)
```

Arguments

D	Particle diameter (m)
lam	Radar wavelength (m)
m	Complex refractive index (unitless)

Value

Qa	Absorption coefficient [unitless]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Doviak, R.J. and Zrnic, D.S., 1993 Doppler radar and weather observations, Academic Press

Louis J. Battan, 1973 Radar Observation of the Atmosphere University of Chicago Press

References

- Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>
- Doviak, R.J. and Zrnić, D.S., 1993 Doppler radar and weather observations, Academic Press
- Louis J. Battan, 1973 Radar Observation of the Atmosphere University of Chicago Press

AttenuationExtCoeff *Extinction coefficient of a spherical particle*

Description

AttenuationExtCoeff Extinction coefficient of a spherical particle. From Doviak and Zrnic (1993), Eqn 3.14a or Battan (1973), Eqn 6.5

Usage

AttenuationExtCoeff(D, lam, m)

Arguments

D	Particle diameter (m)
lam	Radar wavelength (m)
m	Complex refractive index (unitless)

Value

Qe	Extinction coefficient [unitless]
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Author(s)

Jose Gama

Source

- Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>
- Doviak, R.J. and Zrnic, D.S., 1993 Doppler radar and weather observations, Academic Press
- Louis J. Battan, 1973 Radar Observation of the Atmosphere University of Chicago Press

References

- Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>
- Doviak, R.J. and Zrnić, D.S., 1993 Doppler radar and weather observations, Academic Press
- Louis J. Battan, 1973 Radar Observation of the Atmosphere University of Chicago Press

AttenuationScatCoeff *Scattering coefficient of a spherical particle*

Description

AttenuationScatCoeff Scattering coefficient of a spherical particle. From Doviak and Zrnic (1993), Eqn 3.14a or Battan (1973), Eqn 6.5

Usage

AttenuationScatCoeff(D, lam, m)

Arguments

D	Particle diameter (m)
lam	Radar wavelength (m)
m	Complex refractive index (unitless)

Value

Qs Scattering coefficient [unitless]

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Doviak, R.J. and Zrnic, D.S., 1993 Doppler radar and weather observations, Academic Press

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Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Doviak, R.J. and Zrnić, D.S., 1993 Doppler radar and weather observations, Academic Press

Louis J. Battan, 1973 Radar Observation of the Atmosphere University of Chicago Press

ConversiondBZ2Z *Conversion from dBZ (log) units to linear Z units*

Description

ConversiondBZ2Z Converts from dBZ (log) units to linear Z units

Usage

ConversiondBZ2Z(dBZ)

Arguments

dBZ logarithmic reflectivity value

Value

Z linear reflectivity units

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

ConversionZ2dBZ *Conversion from linear Z units to dBZ (log) units*

Description

ConversionZ2dBZ Converts from linear Z units to dBZ (log) units

Usage

ConversionZ2dBZ(Zlin)

Arguments

Zlin linear reflectivity units

Value

dBZ logarithmic reflectivity value

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

DopplerDilemma

Doppler dilemma

Description

DopplerDilemma returns the Doppler dilemma From Rinehart (1997), Eqn 6.12

Usage

```
DopplerDilemma(inFloat, lam, speedOfLight)
```

Arguments

inFloat	Nyquist Velocity [m/s] or Maximum unambiguous range [m]
lam	Radar wavelength [m]
speedOfLight	speed of light

Value

Rmax Maximum unambiguous range [m]

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

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R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

DopplerFmax

Maximum frequency given PRF

Description

DopplerFmax returns the PRF for a maximum frequency From Rinehart (1997), Eqn 6.8

Usage

DopplerFmax(PRF)

Arguments

PRF Pulse repetition frequency [Hz]

Value

f Maximum frequency [Hz]

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

DopplerFreq	<i>Frequency given wavelength</i>
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Description

DopplerFreq Converts from wavelength to frequency

Usage

```
DopplerFreq(lam, speedOfLight)
```

Arguments

lam	Wavelength [m]
speedOfLight	speed of light

Value

f	Frequency [Hz]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

DopplerPulseDuration	<i>Pulse duration from pulse length</i>
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Description

DopplerPulseDuration Converts from pulse length to pulse duration

Usage

```
DopplerPulseDuration(tau, speedOfLight)
```

Arguments

tau	Pulse length [m]
speedOfLight	speed of light

Value

pDur	Pulse duration [s]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

DopplerPulseLength	<i>Pulse length from pulse duration</i>
--------------------	---

Description

DopplerPulseLength Converts from pulse duration to pulse length

Usage

```
DopplerPulseLength(pDur, speedOfLight)
```

Arguments

pDur	Pulse duration [s]
speedOfLight	speed of light

Value

tau	Pulse length [m]
-----	------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

DopplerRmax	<i>Maximum unambiguous range</i>
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Description

DopplerRmax returns the maximum unambiguous range From Rinehart (1997), Eqn 6.11

Usage

```
DopplerRmax(PRF, speedOfLight)
```

Arguments

PRF	Pulse repetition frequency [Hz]
speedOfLight	speed of light

Value

Rmax	Maximum unambiguous range [m]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

DopplerVmax	<i>Nyquist velocity, or maximum unambiguous Doppler velocity (+ or -)</i>
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Description

DopplerVmax returns the Nyquist velocity, or maximum unambiguous Doppler velocity (+ or -).
From Rinehart (1997), Eqn 6.8

Usage

```
DopplerVmax(PRF, lam)
```

Arguments

PRF	Pulse repetition frequency [Hz]
lam	Radar wavelength [m]

Value

Vmax	Nyquist velocity [m/s], +/-
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

DopplerVmaxDual	<i>Doppler velocity from dual PRF scheme radar (+ or -)</i>
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Description

DopplerVmaxDual returns Doppler velocity [m/s] from a mobile platform. From Jorgensen (1983), Eqn 2

Usage

```
DopplerVmaxDual(lam, PRF1, PRF2)
```

Arguments

lam	Radar wavelength [m]
PRF1	First Pulse repetition frequency [Hz]
PRF2	Second Pulse repetition frequency [Hz]

Value

Vmax	Doppler velocity [m/s]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Jorgensen, D., Hildebrand, P.H., and Frush, C., 1983 Feasibility test of an airborne pulse-Doppler meteorological Radar J. Clim. Appl. Meteorol

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Jorgensen, D., Hildebrand, P.H., and Frush, C., 1983 Feasibility test of an airborne pulse-Doppler meteorological Radar J. Clim. Appl. Meteorol

DopplerVshift	<i>Adjusted Doppler velocity from a mobile platform</i>
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Description

DopplerVshift returns Adjusted Doppler velocity from a mobile platform. From Jorgensen (1983), Eqn 2

Usage

```
DopplerVshift(GS, psi)
```

Arguments

GS	Ground speed [m/s]
psi	Angle between actual azimuth and fore/aft angle [deg]

Value

Vshift	Shift in Doppler velocity from mobile aspect [m/s]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Jorgensen, D., Hildebrand, P.H., and Frush, C., 1983 Feasibility test of an airborne pulse-Doppler meteorological Radar J. Clim. Appl. Meteorol

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Jorgensen, D., Hildebrand, P.H., and Frush, C., 1983 Feasibility test of an airborne pulse-Doppler meteorological Radar J. Clim. Appl. Meteorol

DopplerWavelength	<i>Wavelength given frequency</i>
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Description

DopplerWavelength Converts from frequency to wavelength

Usage

```
DopplerWavelength(freq, speedOfLight)
```

Arguments

freq	Frequency [Hz]
speedOfLight	speed of light

Value

lam	Wavelength [m]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

ElectronicWarfareFrequencyBands	<i>Electronic Warfare Frequency Bands</i>
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Description

ElectronicWarfareFrequencyBands has Electronic Warfare Frequency Bands

Usage

```
ElectronicWarfareFrequencyBands
```

Author(s)

Jose Gama

Source

G. Richard Curry, 2011 SciTech Publishing Radar Essentials, A Concise Handbook for Radar Design and Performance Analysis

References

G. Richard Curry, 2011 SciTech Publishing Radar Essentials, A Concise Handbook for Radar Design and Performance Analysis

Examples

```
data(ElectronicWarfareFrequencyBands)
str(ElectronicWarfareFrequencyBands)
```

GeometryBeamBlockFrac *Partial beam blockage fraction*

Description

GeometryBeamBlockFrac returns the partial beam blockage fraction From Bech et al. (2003), Eqn 2 and Appendix

Usage

```
GeometryBeamBlockFrac(Th, Bh, a)
```

Arguments

Th	Terrain height [m]
Bh	Beam height [m]
a	Half power beam radius [m]

Value

PBB	Partial beam blockage fraction [unitless]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Bech et al, 2003 The Sensitivity of Single Polarization Weather Radar Beam Blockage Correction to Variability in the Vertical Refractivity Gradient American Meteorological Society, AMS journals Volume 20 Issue 6

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Bech et al, 2003 The Sensitivity of Single Polarization Weather Radar Beam Blockage Correction to Variability in the Vertical Refractivity Gradient American Meteorological Society, AMS journals Volume 20 Issue 6

GeometryHalfPowerRadius

Half-power radius

Description

GeometryHalfPowerRadius returns the half-power radius Battan (1973)

Usage

```
GeometryHalfPowerRadius(r, bwhalf)
```

Arguments

r	Range [m]
bwhalf	Half-power beam width [degrees]

Value

Rhalf	Half-power radius [m]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Louis J. Battan, 1973 Radar Observation of the Atmosphere University of Chicago Press

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Louis J. Battan, 1973 Radar Observation of the Atmosphere University of Chicago Press

GeometryRangeCorrect *Half-power radius*

Description

GeometryRangeCorrect returns the half-power radius From CSU Radar Meteorology AT 741 Notes

Usage

```
GeometryRangeCorrect(r, h, E)
```

Arguments

r	Distance to sample volume from radar [m]
h	Height of the center of radar volume [m]
E	Elevation angle [deg]

Value

rnew	Adjusted range to sample volume [m]
------	-------------------------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

CSU Radar Meteorology AT 741 Notes

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

CSU Radar Meteorology AT 741 Notes

GeometryRayHeight *Center of radar beam height calculation*

Description

GeometryRayHeight returns the center of radar beam height From Rinehart (1997), Eqn 3.12, Bech et al. (2003) Eqn 3

Usage

```
GeometryRayHeight(r, elev, H0, R1=kConstantR43)
```

Arguments

r	Range from radar to point of interest [m]
elev	Elevation angle of radar beam [deg]
H0	Height of radar antenna [m]
R1	Effective radius [m]

Value

h	Radar beam height [m]
---	-----------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

GeometryReffective *Effective radius calculation*

Description

GeometryReffective returns the effective radius From Rinehart (1997), Eqn 3.9, solved for R'

Usage

```
GeometryReffective(dNdH=-39e-6, earthRadius)
```

Arguments

dNdH	Refraction [N x10 ⁻⁶ /km]
earthRadius	earth radius [m]

Value

R	Effective radius [m]
---	----------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

`GeometrySampleVolGauss`*Sample volume assuming transmitted energy in Gaussian beam shape*

Description

`GeometrySampleVolGauss` returns the sample volume assuming transmitted energy in Gaussian beam shape. From Rinehart (1997), Eqn 5.4

Usage

```
GeometrySampleVolGauss(r, bwH, bwV, pLength)
```

Arguments

<code>r</code>	Range from radar to point of interest [m]
<code>bwH</code>	Horizontal beamwidth [deg]
<code>bwV</code>	Vertical beamwidth deg]
<code>pLength</code>	Pulse length [m]

Value

<code>sVol</code>	Sample Volume [m ³]
-------------------	---------------------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

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R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

GeometrySampleVolIdeal

Sample volume (idealized) assuming all power in half-power beamwidths

Description

GeometrySampleVolIdeal returns the sample volume (idealized) From Rinehart (1997), Eqn 5.2

Usage

```
GeometrySampleVolIdeal(r, bwH, bwV, pLength)
```

Arguments

r	Range from radar to point of interest [m]
bwH	Horizontal beamwidth [deg]
bwV	Vertical beamwidth deg]
pLength	Pulse length [m]

Value

sVol	Sample Volume [m ³]
------	---------------------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

kConstantSpeedOfLight *Constant speed of light*

Description

kConstantSpeedOfLight is "c" the constant speed of light [m/s].

kConstantSLP Sea-level Pressure [hPa].

kConstantP0 Reference pressure [hPa].

kConstantRe Earth's radius [m].

kConstantR43 4/3 Approximation effective radius for standard atmosphere [m].

kConstantBoltz Boltzmann's constant [$\text{m}^2 \text{kg s}^{-2} \text{K}^{-1}$].

Usage

```
kConstantSpeedOfLight
```

Author(s)

Jose Gama

Examples

```
print(kConstantSpeedOfLight)
```

SystemAntEffArea *Antenna effective area*

Description

SystemAntEffArea returns the antenna effective area From Rinehart (1997), Eqn 4.5

Usage

```
SystemAntEffArea(G, lam)
```

Arguments

G	Antenna Gain [dB]
lam	Radar wavelength [m]

Value

Ae	Antenna effective area [unitless]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

SystemFreq	<i>Frequency given wavelength</i>
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Description

SystemFreq Converts from wavelength to frequency

Usage

```
SystemFreq(lam, speedOfLight)
```

Arguments

lam	Wavelength [m]
speedOfLight	speed of light

Value

f	Frequency [Hz]
---	----------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

SystemGainPratio	<i>Antenna gain via power ratio</i>
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Description

SystemGainPratio returns the antenna gain via power ratio From Rinehart (1997), Eqn 2.1

Usage

```
SystemGainPratio(P1, P2)
```

Arguments

P1	Power on the beam axis [W]
P2	Power from an isotropic antenna [W]

Value

G	Gain [dB]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

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R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

SystemNormXsecBscatterSphere

Normalized Backscatter cross-sectional area of a sphere using the Rayleigh approximation

Description

SystemNormXsecBscatterSphere returns the normalized Backscatter cross-sectional area of a sphere using the Rayleigh approximation From Rinehart (1997), Eqn 4.9 and 5.7 and Battan Ch. 4.5

Usage

```
SystemNormXsecBscatterSphere(D, lam, K=0.93)
```

Arguments

D	Diameter of target [m]
lam	Radar wavelength [m]
K	Dielectric factor [unitless]

Value

sigNorm	Normalized backscatter cross-section [unitless]
---------	---

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

L. J. Battan, 1973 Radar observation of the atmosphere The University of Chicago Press

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

L. J. Battan, 1973 Radar observation of the atmosphere The University of Chicago Press

SystemPowerReturnTarget

Power returned by target located at the center of the antenna beam pattern

Description

SystemPowerReturnTarget returns Power returned by target located at the center of the antenna beam pattern From Rinehart (1997), Eqn 4.7

Usage

```
SystemPowerReturnTarget(Pt, G, lam, sig, r)
```

Arguments

Pt	Transmitted power [W]
G	Antenna gain [dB]
lam	Radar wavelength [m]
sig	Backscattering cross-sectional area of target [m ²]
r	Distance to sample volume from radar [m]

Value

Pr	Power returned by target [m]
----	------------------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

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R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

SystemPowerTarget *Power intercepted by target*

Description

SystemPowerTarget returns the power intercepted by target From Rinehart (1997), Eqn 4.3

Usage

```
SystemPowerTarget(Pt, G, Asig, r)
```

Arguments

Pt	Transmitted power [W]
G	Antenna gain [dB]
Asig	Area of target [m ²]
r	Distance to sample volume from radar [m]

Value

Psig	Power intercepted by target [m]
------	---------------------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

SystemRadarConst	<i>Radar constant</i>
------------------	-----------------------

Description

SystemRadarConst returns radar constant From CSU Radar Meteorology notes, AT 741

Usage

```
SystemRadarConst(Pt, G, Tau, lam, bwH, bwV, Lm, Lr)
```

Arguments

Pt	Transmitted power [W]
G	Antenna gain [dB]
Tau	Pulse Width [s]
lam	Radar wavelength [m]
bwH	HorizontalAntenna beamwidth [degrees]
bwV	Vertical antenna beamwidth [degrees]
Lm	Antenna/waveguide/coupler loss [dB]
Lr	Receiver loss [dB]

Value

C	Radar constant [unitless]
---	---------------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

CSU Radar Meteorology notes, AT 741

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

CSU Radar Meteorology notes, AT 741

SystemSizeParam	<i>Size parameter calculation</i>
-----------------	-----------------------------------

Description

SystemSizeParam returns the size parameter calculation From Rinehart (1997), Eqn 4.9 and 5.7 and Battan Ch. 4.5

Usage

```
SystemSizeParam(D, lam)
```

Arguments

D	Diameter of target [m]
lam	Radar wavelength [m]

Value

alpha	Size parameter [unitless]
-------	---------------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

L. J. Battan, 1973 Radar observation of the atmosphere The University of Chicago Press

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

L. J. Battan, 1973 Radar observation of the atmosphere The University of Chicago Press

SystemThermalNoise	<i>Thermal noise power</i>
--------------------	----------------------------

Description

SystemThermalNoise returns the thermal noise power From CSU Radar Meteorology notes, AT741

Usage

```
SystemThermalNoise(Bn, Units, Ts=290, k=kConstantBoltz)
```

Arguments

Bn	Receiver bandwidth [Hz]
Units	String of nits desired, can be 'W' or 'dBm'
Ts	Receiver noise temperature [K]
k	Boltzmann's constant

Value

nt	Thermal noise power [W or 'dBm']
----	----------------------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

CSU Radar Meteorology notes, AT741

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

CSU Radar Meteorology notes, AT741

Systemwavelength	<i>Wavelength given frequency</i>
------------------	-----------------------------------

Description

Systemwavelength Converts from frequency to wavelength

Usage

```
Systemwavelength(freq, speedOfLight)
```

Arguments

freq	Frequency [Hz]
speedOfLight	speed of light

Value

lam	Wavelength [m]
-----	----------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

SystemXsecBscatterSphere

Backscatter cross-sectional area of a sphere using the Rayleigh approximation

Description

SystemXsecBscatterSphere returns Backscatter cross-sectional area of a sphere using the Rayleigh approximation From Rinehart (1997), Eqn 4.9 and 5.7

Usage

```
SystemXsecBscatterSphere(D, lam, K=0.93)
```

Arguments

D	Diameter of target [m]
lam	Radar wavelength [m]
K	Dielectric factor [unitless]

Value

sig	Backscattering cross-section [m ²]
-----	--

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

VariablesCDR	<i>Circular depolarization ratio</i>
--------------	--------------------------------------

Description

VariablesCDR returns the circular depolarization ratio From Rinehart (1997), Eqn 10.2

Usage

```
VariablesCDR(Zpar, Zorth)
```

Arguments

Zpar	Reflectivity in the parallel channel [mm ⁶ /m ³]
Zorth	Reflectivity in the orthogonal channel [mm ⁶ /m ³]

Value

CDR Circular depolarization ratio [dB]

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

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R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

VariablesHDR

Differential reflectivity hail signature

Description

VariablesHDR returns the differential reflectivity hail signature From Aydin et al. (1986), Eqns 4-5

Usage

VariablesHDR(dBZh, ZDR)

Arguments

dBZh Horizontal reflectivity [dBZ]

ZDR Differential reflectivity [dBZ]

Value

ZDP Reflectivity difference [dB]

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

Aydin et al., 1986

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

VariablesLDR	<i>Linear depolarization ratio</i>
--------------	------------------------------------

Description

VariablesLDR returns the linear depolarization ratio From Rinehart (1997), Eqn 10.3

Usage

```
VariablesLDR(Zh, Zv)
```

Arguments

Zh	Horizontal reflectivity [mm^6/m^3]
Zv	Vertical reflectivity [mm^6/m^3]

Value

LDR	linear depolarization ratio
-----	-----------------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

VariablesRadVel	<i>Radial velocity</i>
-----------------	------------------------

Description

VariablesRadVel returns the radial velocity From Rinehart (1993), Eqn 6.6

Usage

```
VariablesRadVel(f, lam)
```

Arguments

f	Frequency shift [Hz]
lam	Radar wavelength [m]

Value

Vr	Radial velocity [m/s]
----	-----------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

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R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

VariablesReflectivity *Radar reflectivity*

Description

VariablesReflectivity returns the radar reflectivity From Rinehart (1993), Eqn 5.17 (See Eqn 5.14-5.16 also)

Usage

VariablesReflectivity(Pt, G, Tau, lam, bwH, bwV, Lm, Lr, Pr, r, K=0.93)

Arguments

Pt	Transmitted power [W]
G	Antenna gain [dB]
Tau	Pulse Width [s]
lam	Radar wavelength [m]
bwH	HorizontalAntenna beamwidth [degrees]
bwV	Vertical antenna beamwidth [degrees]
Lm	Antenna/waveguide/coupler loss [dB]
Lr	Receiver loss [dB]
Pr	Returned power [W]
r	Range to target [m]
K	Dielectric factor [unitless]

Value

Ze	Radar reflectivity [unitless]
----	-------------------------------

Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

References

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

VariablesZDP	<i>Reflectivity difference</i>
--------------	--------------------------------

Description

VariablesZDP returns the reflectivity difference From Rinehart (1997), Eqn 10.2

Usage

VariablesZDP(Zh, Zv)

Arguments

Zh	Horizontal reflectivity [mm ⁶ /m ³]
Zv	Vertical reflectivity [mm ⁶ /m ³]

Value

ZDP	Reflectivity difference [dB]
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Author(s)

Jose Gama

Source

Nick Guy, 2014 PyRadarMet - Python Fundamental Calculations in Radar Meteorology <https://github.com/nguy/PyRadarMet>

R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

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R. E. Rinehart, 1997 Radar for Meteorologists Rinehart Publishing

VariablesZDR	<i>Differential reflectivity</i>
--------------	----------------------------------

Description

VariablesZDR returns the differential reflectivity From Rinehart (1997), Eqn 10.3 and Seliga and Bringi (1976)

Usage

```
VariablesZDR(Zh, Zv)
```

Arguments

Zh	Horizontal reflectivity [mm ⁶ /m ³]
Zv	Vertical reflectivity [mm ⁶ /m ³]

Value

ZDR	Differential reflectivity [dB]
-----	--------------------------------

Author(s)

Jose Gama

Source

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