

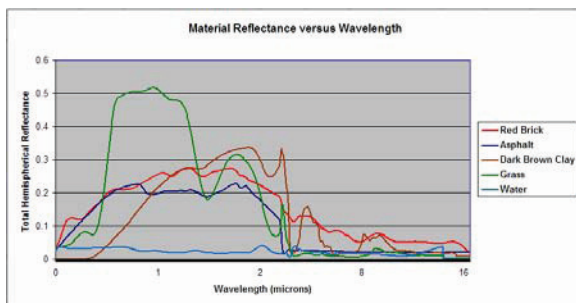
Optical, Thermal and Electromagnetic Properties of Real-World Materials

Utilizing advanced field and laboratory spectrometers, JRM has developed a library of spectral Bidirectional Reflectance Distribution Function (BRDF) and bulk thermal data for over 250 real-world materials from 0.35- 16 μm , at fine spectral resolutions. The library also contains radar mean backscatter coefficients for critical radar frequency bands, polarizations and depression angles for all materials. This library provides a foundation for JRM's comprehensive, accurate end-to-end sensor simulation capability for military and civil applications.

One of the most critical, and yet rare, aspects of sensor simulation is accurate measured material data and knowledge of how that data was obtained. In order to complete its array of physics-based

MATERIAL GROUP	MATERIALS
PaintBlack	7
PaintGreen	4
ConstructionAuxiliary	26
ConstructionBrick	8
ConstructionConcrete	7
ConstructionWood	3
Metal	7
Road	15
Rock	72
SoilClay	7
SoilLoam	8
SoilSand	18
SoilSilt	12
VegetationAutumnDry	6
VegetationFloralFruit	2
VegetationLeaf	48
Water	8
TOTAL	258

products, thereby offering a truly complete end-to-end sensor simulation capability, JRM has established a high-tech laboratory environment in which accurate spectral BRDF and thermal properties can be measured for real-world materials.



JRM's material system concept and material property data format have been accepted as a SEDRIS standard. JRM is leading the way in the development of high-fidelity, physics-based modeling and simulation material property standards.

Material Library Data

JRM's library contains bulk property and spectral BRDF data for all materials. The spectral resolution of the standard commercial version is approximately 0.005 μm below 2.0 μm and 0.05 μm above 2.0 μm .

Mass Density	[kg/m ³]
Thermal Conductivity	[W/m/degK]
Specific Heat Capacity	[J/kg/degK]
Latent Heat of Fusion	[kJ/kg]
Latent Heat of Sublimation	[kJ/kg]
Latent Heat of Evaporation	[kJ/kg]
Stanton Number	[unitless]
Surface normal dependence of Aerodynamic Heating	[unitless]
Soil Type	[enum] no moisture, moisture model, foliage model
Esunmax	[W/m ²] Max sunlight irradiance used to open plant stomata
EvapAreaMin	[unitless] Min fraction of leaf area exposed for evaporation (stomata closed)
EvapAreaMax	[unitless] Max fraction of leaf area exposed for evaporation (stomata open)
Solar Absorptivity	[unitless] 0.2-25 μm average
Lambertian Emissivity	[unitless] 0.2-25 μm average
AngleDHR	[deg] Angle from zenith at which DHR was measured
BRDFModel	[enum] BRDF model to use

Wavelength	[μm]
ReflectFlag	[enum] Data Type : IO (Infrared and EO) or RF
PolarFlag	[enum] Polarization : HH,HV,VH,VV, or UN

Param1	JRM BRDF DHR [unitless]	Ulaby-Dobson RF RCS Constant term [dB]
Param2	JRM BRDF %Specular [unitless 0-100]	Ulaby-Dobson RF RCS Exponential Coeff [dB]
Param3	JRM BRDF Lobe Width [deg]	Ulaby-Dobson RF RCS Zenith Multiplier [unitless] in Exponent
Param4	Sandford-Robertson BRDF Lobe Width parameter [unitless]	Ulaby-Dobson RF RCS Cosine Coeff [dB]
Param5	Sandford-Robertson BRDF Hemispherical Emissivity [unitless]	Ulaby-Dobson RF RCS Zenith Multiplier [unitless] in Cosine Argument
Param6	Sandford-Robertson BRDF Grazing Angle parameter [unitless]	Ulaby-Dobson RF RCS Constant Phase [rad] in Cosine Argument
Param7	Transmittance [unitless]	Ulaby-Dobson RF RCS Standard Deviation Constant term [dB]
Param8	Phong Ambient Reflectivity [unitless]	Ulaby-Dobson RF RCS Standard Deviation Exponential Coeff [dB]
Param9	Phong Diffuse Reflectivity [unitless]	Ulaby-Dobson RF RCS Standard Deviation Zenith Multiplier [unitless] in Exponent
Param10	Phong Specular Reflectivity [unitless]	[unused]
Param11	Phong Shininess [unitless int 0-127]	[unused]

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