

Semi-Automated Image Texture Material Classifier

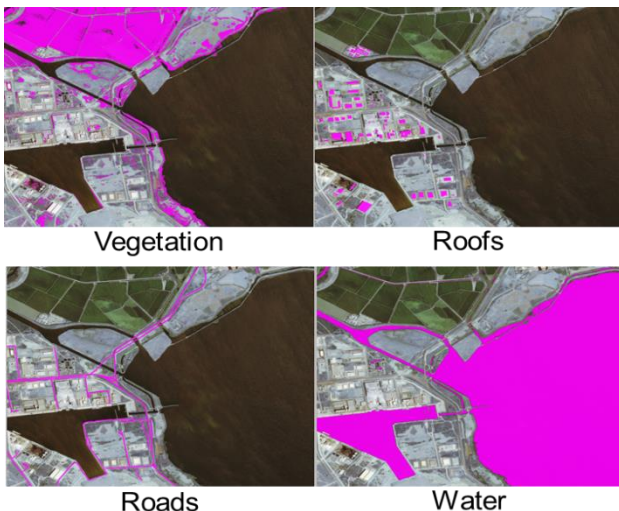
GenesisMC™ is a powerful, comprehensive software tool used with the JRM Material Property Library (JRM-MTL) for creating material-classified textures from remote-sensed terrain imagery or RGB-textured 3D wireframe models -- complete with physical properties & boundary conditions -- for credible, correlated, physics-based EO, IR, & radar sensor simulations.

Powerful Classification Algorithms

GenesisMC contains advanced image processing algorithms for the segmentation, identification and assignment of material classes within an image, including PCA analysis, HSL transforms, ellipsoidal k-means clustering in multichannel color space, and channel ratio metrics (e.g. NDVI). Within each material class segment, GenesisMC leverages JRM's signature synthesis run-time library, SigSim™, to predict and spectrally match particular material species responses to individual pixel colors.

Semi-Automated Classification

GenesisMC allows you to “train and tune” these algorithms on a representative sampling of your class of imagery, and then apply this optimal scheme in a fast “batch” mode to all of your imagery - giving you a reliable classification for hundreds or thousands of tiles at the press of a button.



Material Classified Maps (MCM) & Eigenmaterials

The default output of GenesisMC is a multi-channel Material Classified Map (MCM) texture, where each texel contains material-system (MS) IDs and mixture percentages. Each MS has layered material compositions, thermal boundary conditions, and physical properties. Optional output includes the production of “Eigenmaterial” (Emat) textures, which allow run-time mip-mapping of MS percentages across LODs.

A Comprehensive Material Classification System

GenesisMC has powerful tools for ingesting, managing, viewing, and processing large amounts of multi-channel imagery in a user-friendly and efficient manner. The GenesisMC GUI allows the user to setup a tailored, staged set of unique processing steps optimal for your imagery dataset. A built-in, SigSim-enabled Previewer allows immediate prediction of the resultant classification in the waveband, weather, and time-of-day of your choice.



Original (RGB) Material Encoding IR-band Prediction

Dynamic Heating & Cooling of Active Regions

GenesisMC provides an innovative process for modeling the dynamic surface thermal signature gradients of 3D objects like vehicles. Users can assign “Active Thermal Systems” to portions of the entity model texture (engine, exhaust, tracks, etc.) These regions are then dynamically controlled, and their temperatures recomputed, at run-time in end-user applications.



*Products contain no defense articles, classified, or export controlled (ITAR) data.

Optical, Thermal, and RF Properties of Real-World Materials

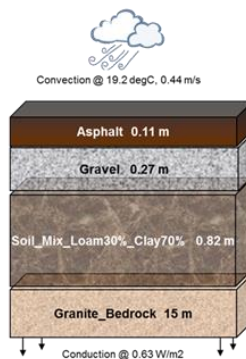
The JRM Material Property Library (JRM-MTL) is a comprehensive library of spectral surface optical, bulk thermophysical, and electromagnetic properties for over 300 natural and man-made materials. These materials are conveniently packaged into 1D layered “material systems (MS)”--with appropriate dynamic-state boundary conditions--for representing all the typical constructs found in 3D scene databases and models (e.g. asphalt shingle roof). These material systems and their associated material physical properties and dynamic boundary conditions are then efficiently assigned to the textures of 3D wireframe models of terrain, objects and entities by the *GenesisMC* tool.

These MS-attributed textures and associated surface geometries drive SigSim’s predictions for correlated EO, IR and RF in real-time, on-the-fly CPU/GPU applications. Intrinsic material data are measured in JRM’s Material Laboratory, with top-of-the-line field and physics laboratory spectrometers and equipment. They include spectral parameters (from 0.35-16 μm) for popular Bidirectional Reflectance Distribution Function (BRDF) models, bulk thermophysical property data such as density, specific heat, and thermal conductivity, and angle-parameterized mean backscatter coefficients for typical radar frequency bands at all polarizations.



Material Library Data

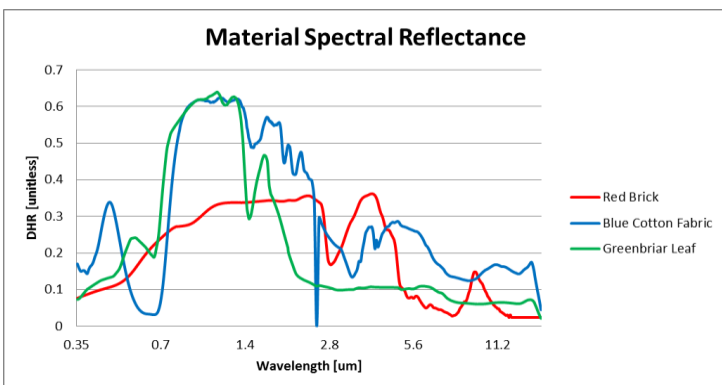
The table below summarizes the JRM MTL data. The spectral resolution of the standard commercial version is approximately 0.005 μm below 2.0 μm and 0.05 μm above 2.0 μm .



Mass Density	[kg/m3]
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/m2] 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	Sanford-Robertson BRDF Lobe Width parameter [unitless]	Ulaby-Dobson RF RCS Cosine Coeff [db]
Param5	Sanford-Robertson BRDF Hemispherical Emissivity [unitless]	Ulaby-Dobson RF RCS Zenith Multiplier [unitless] in Cosine Argument
Param6	Sanford-Robertson BRDF Grazing Angle parameter [unitless]	Ulaby-Dobson RF RCS in 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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