

## Semi-Automated Image Texture Material Classifier

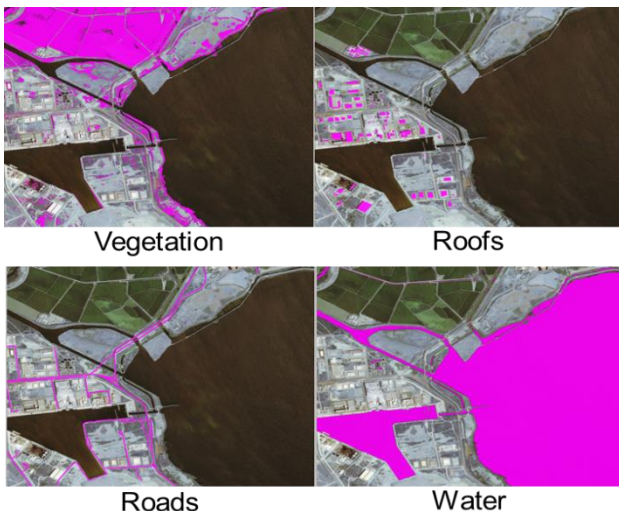
GenesisMC<sup>TM</sup> is a powerful, comprehensive software tool used with the JRM Material Property Library (JRM-MTL) for creating material-classified textures from remote-sensed terrain imagery or RGB-textured 3D wireframe models -- complete with physical properties & boundary conditions -- for credible, 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<sup>TM</sup>, 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<sup>TM</sup>

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 computing 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 during run-time in end-user applications.

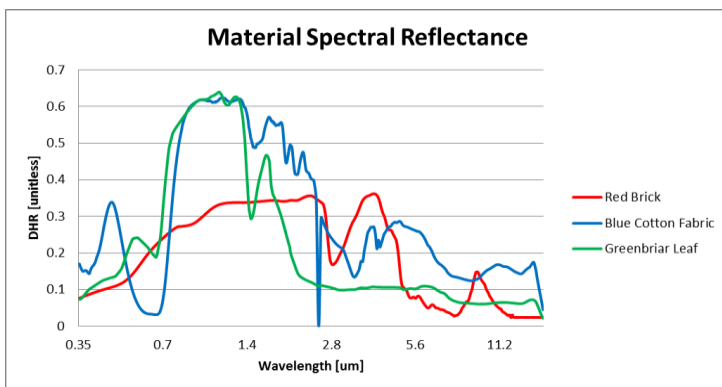


\*Products contain no defense articles, classified, or export controlled (ITAR) data.

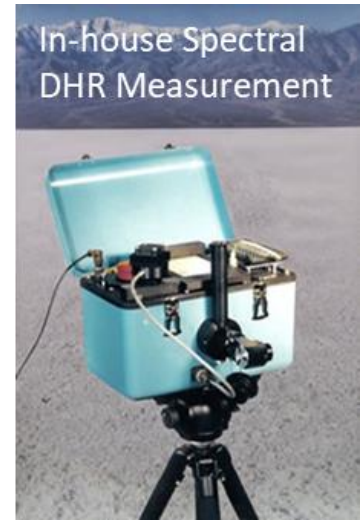
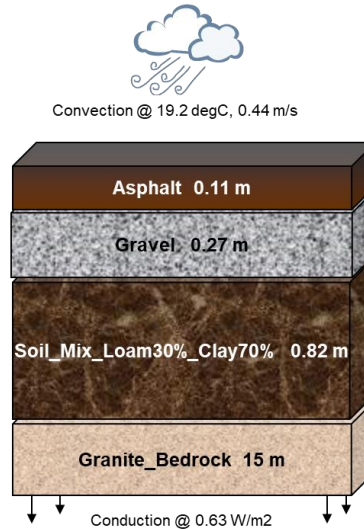
## Optical, Thermal, and RF Properties of Real-World Materials

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 road). These material systems and their associated material physical properties and dynamic boundary conditions are then efficiently assigned to the textures of 3D terrain and entity models 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 laboratory spectrometers. They include spectral parameters (from 0.35-16  $\mu\text{m}$ ) for popular Bidirectional Reflectance Distribution Function (BRDF) models, bulk thermophysical property data such as density, specific heat, and thermal conductivity, acoustic impedance, and angle-parameterized mean backscatter coefficients for typical radar frequency bands at all polarizations. Spectral resolution of the standard commercial version is approximately 0.005 $\mu\text{m}$  below 2.0 $\mu\text{m}$  and 0.05 $\mu\text{m}$  above 2.0  $\mu\text{m}$ . Higher resolution data are available.



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



One advantage to the layered Material System concept is the ability to model buried threats, which will then natively exhibit thermal-band contrast vs. their surroundings, at certain times-of-day.

