open Source days '24
MaterialX and OpenPBR Town Hall

July 23rd, 2024
MaterialX Project Updates 2024 – Jonathan Stone (ASWF, Lucasfilm)
OpenPBR Project Updates 2024 – Adrien Herubel (Autodesk), Peter Kutz (Adobe)
MaterialX in OpenUSD and Hydra – Karen Lucknavalai (Pixar)
MaterialX and OpenPBR in Omniverse – Frankie Liu (NVIDIA)
LookdevX in Maya – Nikola Milosevic, Orn Gunnarsson (Autodesk)
MaterialX in V-Ray – Mihail Djurev (Chaos)
MaterialX in Houdini 20.5 – Chris Rydalch (SideFX)
MaterialX 1.38.8 Release

• Autodesk and SideFX contributed a rich set of new pattern nodes
• Apple contributed support for MaterialX on iOS
• Added support for MaterialX Python installation through PyPI
• Improved GGX importance sampling in real-time shading
ASWF Dev Days 2023

- Provided dedicated mentorship to new contributors over two days
- 14 new MaterialX contributors, including developers from Wētā, ILM, and Autodesk
- Dev Days 2024 will be in September, see https://www.aswf.io/dev-days-2024/ for details
Alliance for OpenUSD

- Launched in 2023 to develop a normative specification for USD
- Formed a Materials Working Group in 2024
- New group is focused on the MaterialX integration in USD
- See [https://aousd.org/](https://aousd.org/) for details
MaterialX 1.39.0 Release

- Major updates to the specification and codebase
- Adds support for the OpenPBR Surface shading model
- Updates the Physically Based Shading and pattern nodes
- Significant optimizations to real-time shading
Join the Conversation

• Visit www.materialx.org to learn more about the project
• Visit https://www.aswf.io/get-involved/ to join the conversation
• Visit https://www.aswf.io/dev-days-2024/ to join Dev Days 2024
Virtual Town Hall Series

OpenPBR Project Update 2024

Adrien Herubel, Autodesk
Peter Kutz, Adobe
OpenPBR update

- State of OpenPBR
- Overview of new features
- Integrations
- Future work
OpenPBR: A new standard

- Merging Standard Surface and Standard Material
  - Autodesk and Adobe share a user base
  - Facilitate asset exchange between vendors
- Physically based
- Artist friendly
- Open governance to drive consensus and adoption
- Reference implementation
OpenPBR project timeline

- **Nov 2022:** Common ground
- **Apr 2023:** New specification
- **Jun 2023:** ASWF
- **Aug 2023:** Announce and private reviews
- **Oct 2023:** Public preview
- **Now:** 1.0 release
OpenPBR project outcomes

• Finalized specification
• Unifies Autodesk Standard Surface and Adobe Standard Material, with some enhancements
• MaterialX reference implementation
• ASWF governance model
• Major interest from end-users and vendors
OpenPBR Surface

Specification

This document is a specification of a surface shading model intended as a standard for computer graphics. It is designed to provide a consistent representation and functionality for accurately modeling the vast majority of real materials used in practical visual effects and feature animation productions.

OpenPBR Surface is an open standard hosted by the Academy Software Foundation (ASWF), and is inspired by the material behaviors used in the feature film "Mad Max: Fury Road" and the Unreal Engine's "Metal" shading model.

Open source repo and specification
Energy-preserving Oren–Nayar
Energy-preserving Oren–Nayar
Energy-preserving Oren–Nayar

QON

EON
Energy-preserving Oren–Nayar

smooth

rough
New fuzz model

• New Fuzz model using Zeltner '22
• Based on energy-conserving microflake multiple scattering
• Perfect importance sampling
• Improved range over popular microfacet models
New fuzz model

Zeltner '22 sheen

SPI sheen
Coat darkening

- New base color darkening
- Based on real internal reflection and re-absorption
- Opt-out
Coat darkening

0.00  0.25  0.50  0.75  1.00
Dispersion scale

0.0
0.5
1.0
1.5
2.0
More expressive layer ordering
Art-directable metal model

Gulbrandsen

F82-Tint
Other user-friendly tweaks

- More intuitive thin-film parameterization
- More natural specular weight
OpenPBR integrations

- MaterialX 1.39
- Adobe Substance
- Arnold
- Maya
- 3ds Max
- Omniverse
- Houdini Karma
OpenPBR integration: MaterialX 1.39
OpenPBR integration: Adobe Substance
OpenPBR integration: Arnold

Artwork by Nikie Monteleone
OpenPBR integration: Maya
OpenPBR integration: 3ds Max
OpenPBR integration: Omniverse

Artwork by Nikie Monteleone
OpenPBR integration: Karma
OpenPBR: Future work

- Increase OpenPBR and MaterialX 1.39 adoption
- Continuously review feedback and new ideas
- Shader translation graphs from/to Standard Surface
- Extending OpenPBR
  - Volumes
  - Hair
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MaterialX in OpenUSD & Hydra

Karen Lucknavalai, Pixar

July 23, 2024
MaterialX in USD/Hydra - Updates

Dev branch changes
- Support for MaterialX v1.38.10
- Vulkan ShaderGen support
- Material Tag detection fixes
- MaterialX in Hydra USD Developer Guide
- Improved glslfx shader caching
MaterialX in USD/Hydra - Updates

Release branch changes

• Colorspace support to HdMtlx and Storm *
• Update imaging tests
• Normal map fixes for Storm and Prman

* full colorspace support in USD is still IP
MaterialX in USD/Hydra - Updates

Release branch changes
  • Colorspace support to HdMtlx and Storm *
  • Update imaging tests
  • Normal map fixes for Storm and Prman

* full colorspace support in USD is still IP
MaterialX in USD/Hydra - Updates

Bug Fixes

- Name collision with inputs and built-in uniforms in Storm
- OIT fix for Metal
- Shader compile fix when using `heighttonormal` nodes
- `fileprefix` appropriately applied to filenames
MaterialX in USD/Hydra - Updates

Prman bug fixes
- Nodes used in multiple places within a material
- Correct search paths

More information about Renderman, OSL and MaterialX:

OSL Virtual Town Hall
Today at 4p MDT
Virtual Town Hall Series

Material Exchange in Omniverse with MaterialX and OpenPBR

Charles Anderson, Derek Haase, Jan Jordan, Minjae Lee, Frankie Liu, Kai Rohmer, Masuo Suzuki and the NVIDIA Team
Design, Build, Optimize - Virtually

- Autonomous Vehicles
- Robotics
- Performance
- Factory
- Factory
- Design
First Class MaterialX Support
OpenPBR Library
describe_model
{
  "model_name": "Luxury HandBag",
  "description": "The 'Luxury HandBag' typically features a combination of high-end, durable and aesthetically pleasing materials. It is usually a fashion accessory with a structured body, a handle for carrying, and various decorative and functional components such as rings, legs, a lock, and sometimes a clochette for keys or decoration. Common materials for its components include:

  **Cover:** Leather (such as cowhide, lambskin or exotic skins) or high-quality synthetic materials designed to mimic leather.

  **Handle:** Leather wrapped around a sturdy core material such as metal or hard plastic, or entirely made of these materials.

  **Body:** Premium leathers, vegan leathers, or structured textiles often reinforced with an internal frame made of metal or hard plastic.

  **Ring:** Metal alloys such as brass, gold-plated metal, or stainless steel for structural support and decorative elements.

  **Legs:** Metal to protect the bottom of the bag and to provide stability when placed on surfaces.

  **Handle Rings:** Metal, often the same as the rings for design consistency and durability.

  **Lock:** Metal such as brass, nickel, or gold-plated components; may include a small amount of plastic or rubber for the locking mechanism.

  **Clochette:** Leather or a high-quality synthetic material, occasionally with metal hardware.

These materials are selected for their quality, longevity, and to provide a luxurious feel and appearance to the handbag."
}
MaterialX Authoring
Future Work
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These statements reflect management’s current expectations, estimates and assumptions based on the information currently available to Autodesk. These forward-looking statements are not guarantees of future performance and involve significant risks, uncertainties and other factors that may cause Autodesk’s accrual results, performance or achievements to be materially different from results, performance or achievements expressed or implied by the forward-looking statements contained in this presentation. A discussion of the factors that may affect future results is contained in Autodesk’s most recent SEC Form 10-K and Form 10-Q filings, including descriptions of the risk factors that may impact Autodesk and the forward-looking statements made in this presentation. If this presentation is reviewed after the time and date this presentation was first recorded, even if it subsequently is made available by Autodesk, on its web site or otherwise, this presentation may not contain current or accurate information.

Autodesk disclaims any obligation to update or revise any forward-looking statement based on new information, future events or otherwise.
LookdevX | Agnostic Material Editor

- Native USD & MaterialX authoring
- Open Rendering
- Enabled for DCC portability
LookdevX | Release Highlights

2024  Native USD Material Support

2024.2  Workflow improvements

2025  Native MaterialX Support

2025.x  Workflow improvements
Enabling MaterialX Workflows

Natively Authoring MaterialX Graphs in Maya using LookdevX as agnostic authoring shader toolset. Assign materials to Maya geometry and manage it through known direct material assignments workflows.
Maya 2025 | LookdevX

- Unifying different datatype workflows
  - Introducing Multiple runtimes

- Enable LookdevX as Agnostic Editor
  - Choose your shading data - Starting screen
  - Creating Shading data models per specific Tabs
    - Graph, Tabs, Nodes
Maya 2025 | LookdevX

- MaterialX Document Stack I/O
- MaterialX Document I/O
- Native Maya MaterialX Assignment
  - Outliner, VP, LookdevX
Maya 2025 | LookdevX

- Graph Creation Improvements
- Material Authoring enhancements
- Toolbar – Icon shelf
- Improving workflows Performance
Maya 2025 | Arnold support

- Exposed Arnold Materials Through MatX
- Supporting Maya MaterialX Library
- Arnold Icons
LookdevX | Open rendering

- Third party renderers can express their graphs through LookdevX
  - Shader discovery through USD schemas and MaterialX node definitions
  - Leveraging LookdevX UX features
    - Solo, Node icons, Icons, Node graphs etc
Road map - Maya 2025.X
Maya 2025.1 | LookdevX

Key Features

- Hide input Nodes
- Assigning New & Existing Materials
- Node Library UI
- Supporting Volume Shaders
- VP support for Arnold materials through MaterialX
Key Features

- Ramp node
- Dynamic Port Workflow – Smart Connections
- Exposed Material Binding and Inheritance in AE
- VP support for Arnold materials through MaterialX
Maya 2025.X | LookdevX

Key Features

- Publishing workflows (Phase I) - MaterialX
- USD Referencing MaterialX graphs – Cleanup
- Relative path support – MaterialX
- Component Tag’s MaterialX support
- Automation tools (Python bindings)
OpenPBR Material

Maya 2025 | LookdevX
- Exposed through MaterialX from Arnold library

Now | Maya Beta
- Exposed in LookdevX and Maya Hypershade

Next | Maya & 3ds Max
- Open PBR material Native DCC Integration
Hydra | LookdevX

- Hydra support
  - Material graphs can be accurately represented in Storm and Arnold delegate
LookdevX | Contributions

- Image node’s fixes – MaterialX
  - Triplanar, gltf_image, UsdUVTexture

- Loading Material graphs optimization
  - Smart shader generation

- MaterialX OCIO plugin
  - Enable OCIO or OCIO-Nano for color conversions
LookdevX | Planned Contributions

- Ramp node
- Conversion nodes
- Bias and Gain nodes
AI Enabled Workflows | LookdevX

Available for testing in upcoming Maya Beta

- Ethically Collected Data AI Models
- Working with multiple service providers
- Authentication using Autodesk SSO
- API enabled extendable custom Data model
Virtual Town Hall Series

MaterialX in V-Ray

Mihail Djurev, Chaos Software
Chaos V-Ray

- Architectural visualization
Chaos V-Ray

- Architectural visualization
- Product design
Chaos V-Ray

- Architectural visualization
- Product design
- VFX
V-Ray ecosystem in a nutshell

• Has integrations with many DCCs
• Extensible through plugins
• Supports OSL, GLSL and MDL
• V-Ray GPU
  • Most of V-Ray’s functionality reimplemented to run fast on GPUs
  • Used in production
• Vantage
  • Standalone real-time renderer
Why MaterialX?

- Every DCC has its own material nodes
- V-Ray supports them through native nodes or translation
- Exporting is easy, importing is hard
- A common, restricted, complete set of nodes
- Nodegraph implementation
MaterialX in V-Ray implementation

- Writing renderer integrations is hard
- Native V-Ray implementation for each MaterialX node
- Same node and attribute name in V-Ray and MaterialX
- Minimize translation
- Native integration solves compilation time
MaterialX nodes in V-Ray

- Used code generation
  - Mapped existing V-Ray nodes to MaterialX nodes when possible
  - Present as a single node

- Support MaterialX node graph definitions internally

- Transpiled OSL & MDL code for procedural textures
Future plans

- OpenPBR support
- V-Ray material nodegraph definition
  - Allows us to display V-Ray material in other MaterialX applications
- MaterialX support in Vantage
MaterialX in Houdini 20.5

Chris Rydalch, SideFX
July 23, 2024
MaterialX in Houdini 20.5

- Overview
- Quick Surface Materials
- Copernicus
Overview
MaterialX in Houdini 20.5

- MaterialX first included with H19.0
- Initial adoption motivated by Karma XPU
  - Need to build materials for both Karma delegates
- Takes a “MaterialX-as-Spec” approach
  - Renderers ingest shading graphs on-the-fly
  - No reliance on MaterialX code-gen
- Focused on USD-encoded MaterialX materials
- Super-set of Karma-specific nodes where needed
MaterialX in Houdini 20.5

- **Houdini**
  - H20.5 released July 10th
- **USD**
  - 24.03 (from 23.08)
- **MaterialX**
  - 1.38.10 (from 1.38.8)

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Quick Surface Material
MaterialX in Houdini 20.5

- Quick Surface Material
  - Uses standard MaterialX nodes
  - Based around mtlxstandard_surface*
- Referenced from USD layer
  - Users adjust public interface
  - Instanceable references by default
- Shared materials/prims = more efficient scenes
- Less context diving/switching for artists
- Initial workflow/pipeline possibilities with UsdShade

* OpenPBR planned for future releases
Copernicus
MaterialX in Houdini 20.5

- New, Fast Image-Processing Engine and Context in Houdini
- Embraces open standards
  - OpenCL for most nodes
  - OpenFX plugin support
- Copernicus maps via MaterialX texture nodes, update live in Solaris
- Many workflows are still in-progress (i.e. it’s beta!)
Thank You!

Questions?