

Known Problems

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Last Modified: October 25, 2020

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The date shown before each issue is when the problem was posted in this document. As the GeometricTools-based issues are resolved, they will be removed from this document. For other packages, the issues will remain listed here because I have no control over whether or when they will be addressed by the owners of those packages. Even if they are fixed, developers using the buggy packages need to know that the problems do exist and, most likely, the developers should upgrade to newer packages where the bugs no longer exist.

1 Issues in Geometric Tools

1.1 Report of a Bug During a Linear Walk in Constrained Delaunay Triangulation

October 25, 2020. During the rewrite of `MinimumVolumeBox3`, I tried to use `ExtremalQuery3BSP` for a fast search for extreme vertices of a convex polyhedron. The code produced incorrect results. This is surprising, given that the `GeometricTools/Samples/Geometrics/ExtremalQuery` sample (which demonstrates the use of the class) appears to produce correct results. This needs to be investigated.

May 9, 2019. A user reported that there is a bug, but he provided only a link to a document about how linear walks in this situation might not be linear. I asked for a test dataset to reproduce the error but none was provided. He also mentioned that the pseudodistance function `ComputePSD` is incorrect, once again without a test dataset. This needs to be investigated, but is low priority until I receive a test dataset or another user reports a problem.

2 Issued with Packages that Geometric Tools Depends On

2.1 Random Failure to Destroy All `ID3D11Device` Objects

October 25, 2020. On random occasions, an exception in `DX11Engine::DestroyDevice` is thrown on exit from an application. The code is

```
// Code in DX11Engine.
bool DX11Engine::DestroyDevice()
{
    return DX11::FinalRelease(mImmediate) == 0 && DX11::FinalRelease(mDevice) == 0;
}

// Code in DX11.h.
template <typename T>
static ULONG FinalRelease(T*& object)
{
    if (object)
    {
        ULONG refs = object->Release();
        object = nullptr;
        if (refs > 0)
        {
            LogError("Reference count is not zero after release.");
        }
    }
    return 0;
}
```

The `DX11::FinalRelease(mDevice)` call throws the exception because the `mDevice` reference count is positive.

I have seen this random problem for quite some time, investigating it as if my code had a reference-count bug. I am only now posting the issue because I was able to collect enough information to decide the problem is not in my code.

Recently I was working with a project where the exception was thrown each time the application exited. This gave me a chance to enable the DXGI Debug Layer using

```
#include "MyAppWindow2.h"
#include <Applications/LogReporter.h>

int main()
{
    #if defined(_DEBUG)
        LogReporter reporter(
            "LogReport.txt",
            Logger::Listener::LISTEN_FOR_ALL,
            Logger::Listener::LISTEN_FOR_ALL,
            Logger::Listener::LISTEN_FOR_ALL,
            Logger::Listener::LISTEN_FOR_ALL);
    #endif

    Window::Parameters parameters(L" MyAppWindow2", 0, 0, 1024, 1024);
    parameters.deviceCreationFlags = D3D11.CREATE_DEVICE_DEBUG;
    auto window = TheWindowSystem.Create<MyAppWindow2>(parameters);
    TheWindowSystem.MessagePump(window, TheWindowSystem.NO_IDLE_LOOP);
    TheWindowSystem.Destroy(window);
    return 0;
}
```

I also launched the DirectX Control Panel to add the executable to the list of programs to monitor. I selected the Force On option for the debug layer. In the Message Settings, I did not mute any message type. In the Break Settings, I checked the boxes for Enable break on functionality, Corruption, Error and Warning.

For an execution that throws the exception, the output messages are

```

D3D11 INFO: Create ID3D11Context: Name="unnamed", Addr=0x0000026176506F80, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097225: CREATE_CONTEXT]
D3D11 INFO: Create ID3DDeviceContextState: Name="unnamed", Addr=0x00000261786640D0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #3145735: CREATE_DEVICECONTEXTSTATE]
D3D11 INFO: Create ID3D11BlendState: Name="unnamed", Addr=0x00000261785ADF60, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097270: CREATE_BLENDSTATE]
D3D11 INFO: Create ID3D11DepthStencilState: Name="unnamed", Addr=0x00000261785AE470, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097273: CREATE_DEPTHSTENCILSTATE]
D3D11 INFO: Create ID3D11RasterizerState: Name="unnamed", Addr=0x00000261785AE660, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097276: CREATE_RASTERIZERSTATE]
D3D11 INFO: Create ID3D11Sampler: Name="unnamed", Addr=0x00000261785AE9A0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097267: CREATE_SAMPLER]
D3D11 INFO: Create ID3D11Query: Name="unnamed", Addr=0x00000261785AEB90, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097279: CREATE_QUERY]
D3D11 INFO: Create ID3D11Fence: Name="unnamed", Addr=0x00000261785AEDC0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #3146249: CREATE_FENCE]
D3D11 INFO: Destroy ID3D11Fence: Name="unnamed", Addr=0x00000261785AEDC0 [ STATE_CREATION INFO #3146251: DESTROY_FENCE]
DXGI WARNING: IDXGIFactory::CreateSwapChain: Bit-model swap effects (DXGI_SWAP_EFFECT_DISCARD and DXGI_SWAP_EFFECT_SEQUENTIAL) are legacy swap effects that are
predominantly superceded by their flip-model counterparts (DXGI_SWAP_EFFECT_FLIP_SEQUENTIAL and DXGI_SWAP_EFFECT_FLIP_DISCARD). Please consider
updating your application to leverage flip-model swap effects to benefit from modern presentation enhancements. More information is available
at http://aka.ms/dxgiflipmodel. [ MISCELLANEOUS WARNING #294: ]
D3D11 INFO: Create ID3D11Texture2D: Name="unnamed", Addr=0x0000026178670320, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097234: CREATE_TEXTURE2D]
D3D11 INFO: Create ID3D11RenderTargetView: Name="unnamed", Addr=0x0000026178670FC0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097243: CREATE_RENDERTARGETVIEW]
D3D11 INFO: Create ID3D11Texture2D: Name="unnamed", Addr=0x0000026178671200, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097234: CREATE_TEXTURE2D]
D3D11 INFO: Create ID3D11Texture2D: Name="unnamed", Addr=0x0000026178675E70, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097234: CREATE_TEXTURE2D]
D3D11 INFO: Create ID3D11DepthStencilView: Name="unnamed", Addr=0x000002617867AB20, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097246: CREATE_DEPTHSTENCILVIEW]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x0000026178691CC0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x00000261786920A0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x0000026176564110, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x0000026178698910, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11VertexShader: Name="unnamed", Addr=0x0000026178699580, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097249: CREATE_VERTEXSHADER]
D3D11 INFO: Create ID3D11PixelShader: Name="unnamed", Addr=0x00000261786A6760, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097261: CREATE_PIXELSHADER]
D3D11 INFO: Create ID3D11DepthStencilState: Name="unnamed", Addr=0x00000261786A7AEO, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097273: CREATE_DEPTHSTENCILSTATE]
D3D11 INFO: Create ID3D11RasterizerState: Name="unnamed", Addr=0x00000261786A7C00, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097276: CREATE_RASTERIZERSTATE]
D3D11 INFO: Create ID3D11DepthStencilState: Name="unnamed", Addr=0x00000261786EAC50, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097273: CREATE_DEPTHSTENCILSTATE]
D3D11 INFO: Create ID3D11Texture2D: Name="unnamed", Addr=0x00000261786F3160, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097234: CREATE_TEXTURE2D]
D3D11 INFO: Create ID3D11ShaderResourceView: Name="unnamed", Addr=0x00000261786F1900, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097240: CREATE_SHADERRESOURCEVIEW]
D3D11 INFO: Create ID3D11VertexShader: Name="unnamed", Addr=0x00000261786FAFF0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097249: CREATE_VERTEXSHADER]
D3D11 INFO: Create ID3D11PixelShader: Name="unnamed", Addr=0x00000261786FB900, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097261: CREATE_PIXELSHADER]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x00000261786FDC70, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Sampler: Name="unnamed", Addr=0x00000261786FDF70, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097267: CREATE_SAMPLER]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x00000261786FAC10, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11InputLayout: Name="unnamed", Addr=0x000002617862A870, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097264: CREATE_INPUTLAYOUT]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x00000261786FBFF0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Context: Name="unnamed", Addr=0x00000261787355D0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097225: CREATE_CONTEXT]
D3D11 INFO: Create ID3D11RenderTargetView: Name="unnamed", Addr=0x00000261786F3550, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097243: CREATE_RENDERTARGETVIEW]
D3D11 INFO: Create ID3D11BlendState: Name="unnamed", Addr=0x000002617871F2A0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097270: CREATE_BLENDSTATE]
D3D11 INFO: Create ID3D11ClassLinkage: Name="unnamed", Addr=0x0000026178758CE0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097293: CREATE_CLASSLINKAGE]
D3D11 INFO: Create ID3D11Sampler: Name="unnamed", Addr=0x000002617875F6C0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097267: CREATE_SAMPLER]
D3D11 INFO: Create ID3D11VertexShader: Name="unnamed", Addr=0x00000261786FB3D0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097249: CREATE_VERTEXSHADER]
D3D11 INFO: Create ID3D11PixelShader: Name="unnamed", Addr=0x00000261786FB7B0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097261: CREATE_PIXELSHADER]
D3D11 INFO: Create ID3D11InputLayout: Name="unnamed", Addr=0x00000261787548D0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097264: CREATE_INPUTLAYOUT]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x00000261786FC350, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Texture2D: Name="unnamed", Addr=0x00000261787690CA0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097234: CREATE_TEXTURE2D]
D3D11 INFO: Create ID3D11Query: Name="unnamed", Addr=0x000002617875A190, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097279: CREATE_QUERY]
D3D11 INFO: Destroy ID3D11Query: Name="unnamed", Addr=0x000002617875A190 [ STATE_CREATION INFO #2097281: DESTROY_QUERY]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x0000026178698910 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11PixelShader: Name="unnamed", Addr=0x00000261786A6760 [ STATE_CREATION INFO #2097263: DESTROY_PIXELSHADER]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x0000026176564110 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11VertexShader: Name="unnamed", Addr=0x0000026178699580 [ STATE_CREATION INFO #2097251: DESTROY_VERTEXSHADER]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x00000261786920A0 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x0000026178691CC0 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11Texture2D: Name="unnamed", Addr=0x0000026178671200 [ STATE_CREATION INFO #2097236: DESTROY_TEXTURE2D]

GTE ERROR:
File: my_path/GeometricTools/GTE/Graphics/DX11/DX11.h
Func: gte::DX11::FinalRelease
Line: 64
Reference count is not zero after release.

Debug Error!

Program: my_executable

abort() has been called

(Press Retry to debug the application)
Exception thrown at 0x00007FFD2483E49 in my_executable: Microsoft C++ exception: std::runtime_error at memory location 0x000007300DFE9F8.
D3D11 WARNING: Process is terminating. Using simple reporting. Please call ReportLiveObjects() at runtime for standard reporting. [ STATE_CREATION WARNING #0: UNKNOWN]
D3D11: **BREAK** enabled for the previous message, which was: [ WARNING STATE_CREATION #0: UNKNOWN ]
Exception thrown at 0x00007FFD2483E49 (KernelBase.dll) in my_executable: 0x0000087A (parameters: 0x0000000000000002, 0x000007300DFA0B0, 0x000007300DFAE10).
DXGI WARNING: Process is terminating. Using simple reporting. Please call ReportLiveObjects() at runtime for standard reporting. [ STATE_CREATION WARNING #0: ]
DXGI WARNING: Live Producer at 0x00000261764EC258, Refcount: 4. [ STATE_CREATION WARNING #0: ]
DXGI WARNING: Live Object at 0x00000261764EC6C0, Refcount: 2. [ STATE_CREATION WARNING #0: ]
DXGI WARNING: Live Object : 1 [ STATE_CREATION WARNING #0: ]

```

For an execution that terminates normally, the output messages are

```
D3D11 INFO: Create ID3D11Context: Name="unnamed", Addr=0x0000026DF5D76F80, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097225: CREATE_CONTEXT]
D3D11 INFO: Create ID3DDeviceContextState: Name="unnamed", Addr=0x0000026DF7F0C802, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #3145735: CREATE_DEVICECONTEXTSTATE]
D3D11 INFO: Create ID3D11BlendState: Name="unnamed", Addr=0x0000026DF5DEEDD0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097270: CREATE_BLENDSTATE]
D3D11 INFO: Create ID3D11DepthStencilState: Name="unnamed", Addr=0x0000026DF7F0C230, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097273: CREATE_DEPTHSTENCILSTATE]
D3D11 INFO: Create ID3D11RasterizerState: Name="unnamed", Addr=0x0000026DF7F0C420, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097276: CREATE_RASTERIZERSTATE]
D3D11 INFO: Create ID3D11Sampler: Name="unnamed", Addr=0x0000026DF7F0C760, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097267: CREATE_SAMPLER]
D3D11 INFO: Create ID3D11Query: Name="unnamed", Addr=0x0000026DF7F0C950, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097279: CREATE_QUERY]
D3D11 INFO: Create ID3D11Fence: Name="unnamed", Addr=0x0000026DF7F0CB80, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #3146249: CREATE_FENCE]
D3D11 INFO: Destroy ID3D11Fence: Name="unnamed", Addr=0x0000026DF7F0CB80 [ STATE_CREATION INFO #3146251: DESTROY_FENCE]
DXGI WARNING: IDXGIFactory::CreateSwapChain: Bit-model swap effects (DXGI_SWAP_EFFECT_DISCARD and DXGI_SWAP_EFFECT_SEQUENTIAL) are legacy swap effects that are
predominantly superseded by their flip-model counterparts (DXGI_SWAP_EFFECT_FLIP_SEQUENTIAL and DXGI_SWAP_EFFECT_FLIP_DISCARD). Please consider
updating your application to leverage flip-model swap effects to benefit from modern presentation enhancements. More information is available
at http://aka.ms/dxgiflipmodel. [ MISCELLANEOUS WARNING #294: ]
D3D11 INFO: Create ID3D11Texture2D: Name="unnamed", Addr=0x0000026DF7F0DA70, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097234: CREATE_TEXTURE2D]
D3D11 INFO: Create ID3D11RenderTargetView: Name="unnamed", Addr=0x0000026DF7F0E880, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097243: CREATE_RENDERTARGETVIEW]
D3D11 INFO: Create ID3D11Texture2D: Name="unnamed", Addr=0x0000026DF7F0EAC0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097234: CREATE_TEXTURE2D]
D3D11 INFO: Create ID3D11Texture2D: Name="unnamed", Addr=0x0000026DF7F07C00, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097234: CREATE_TEXTURE2D]
D3D11 INFO: Create ID3D11DepthStencilView: Name="unnamed", Addr=0x0000026DF7F0C8B0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097246: CREATE_DEPTHSTENCILVIEW]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x0000026DF7FF3910, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x0000026DF7FF3CF0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x0000026DF5DD40C0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x0000026DF7FFA560, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11VertexShader: Name="unnamed", Addr=0x0000026DF7FFB1D0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097249: CREATE_VERTEXSHADER]
D3D11 INFO: Create ID3D11PixelShader: Name="unnamed", Addr=0x0000026DF8006730, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097261: CREATE_PIXELSHADER]
D3D11 INFO: Create ID3D11DepthStencilState: Name="unnamed", Addr=0x0000026DF808E6E0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097273: CREATE_DEPTHSTENCILSTATE]
D3D11 INFO: Create ID3D11RasterizerState: Name="unnamed", Addr=0x0000026DF8007C90, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097276: CREATE_RASTERIZERSTATE]
D3D11 INFO: Create ID3D11DepthStencilState: Name="unnamed", Addr=0x0000026DF802C1B0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097273: CREATE_DEPTHSTENCILSTATE]
D3D11 INFO: Create ID3D11Texture2D: Name="unnamed", Addr=0x0000026DF802C540, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097234: CREATE_TEXTURE2D]
D3D11 INFO: Create ID3D11ShaderResourceView: Name="unnamed", Addr=0x0000026DF8033750, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097242: CREATE_SHADERRESOURCEVIEW]
D3D11 INFO: Create ID3D11VertexShader: Name="unnamed", Addr=0x0000026DF7F65F10, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097249: CREATE_VERTEXSHADER]
D3D11 INFO: Create ID3D11PixelShader: Name="unnamed", Addr=0x0000026DF8041EB0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097261: CREATE_PIXELSHADER]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x0000026DF8066220, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Sampler: Name="unnamed", Addr=0x0000026DF80397F0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097267: CREATE_SAMPLER]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x0000026DF8079990, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11InputLayout: Name="unnamed", Addr=0x0000026DF7F890C0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097264: CREATE_INPUTLAYOUT]
D3D11 INFO: Create ID3D11Buffer: Name="unnamed", Addr=0x0000026DF803E180, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097228: CREATE_BUFFER]
D3D11 INFO: Create ID3D11Texture2D: Name="unnamed", Addr=0x0000026DF80651C0, ExtRef=1, IntRef=0 [ STATE_CREATION INFO #2097234: CREATE_TEXTURE2D]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x0000026DF7FFA560 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11PixelShader: Name="unnamed", Addr=0x0000026DF8006730 [ STATE_CREATION INFO #2097263: DESTROY_PIXELSHADER]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x0000026DF8066220 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11VertexShader: Name="unnamed", Addr=0x0000026DF7FFB1D0 [ STATE_CREATION INFO #2097251: DESTROY_VERTEXSHADER]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x0000026DF7FF3CF0 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x0000026DF7FF3910 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11Texture2D: Name="unnamed", Addr=0x0000026DF7F0EAC0 [ STATE_CREATION INFO #2097236: DESTROY_TEXTURE2D]
D3D11 INFO: Destroy ID3D11Query: Name="unnamed", Addr=0x0000026DF7F0C950 [ STATE_CREATION INFO #2097281: DESTROY_QUERY]
D3D11 INFO: Destroy ID3D11RasterizerState: Name="unnamed", Addr=0x0000026DF7F0C420 [ STATE_CREATION INFO #2097278: DESTROY_RASTERIZERSTATE]
D3D11 INFO: Destroy ID3D11DepthStencilState: Name="unnamed", Addr=0x0000026DF7F0C230 [ STATE_CREATION INFO #2097275: DESTROY_DEPTHSTENCILSTATE]
D3D11 INFO: Destroy ID3D11BlendState: Name="unnamed", Addr=0x0000026DF5DEEDD0 [ STATE_CREATION INFO #2097272: DESTROY_BLENDSTATE]
D3D11 INFO: Destroy ID3D11DepthStencilView: Name="unnamed", Addr=0x0000026DF7F0C8B0 [ STATE_CREATION INFO #2097248: DESTROY_DEPTHSTENCILVIEW]
D3D11 INFO: Destroy ID3D11Texture2D: Name="unnamed", Addr=0x0000026DF7F07C00 [ STATE_CREATION INFO #2097236: DESTROY_TEXTURE2D]
D3D11 INFO: Destroy ID3D11RenderTargetView: Name="unnamed", Addr=0x0000026DF7F0E880 [ STATE_CREATION INFO #2097245: DESTROY_RENDERTARGETVIEW]
D3D11 INFO: Destroy ID3D11Texture2D: Name="unnamed", Addr=0x0000026DF80651C0 [ STATE_CREATION INFO #2097236: DESTROY_TEXTURE2D]
D3D11 INFO: Destroy ID3D11Texture2D: Name="unnamed", Addr=0x0000026DF7F0DA70 [ STATE_CREATION INFO #2097236: DESTROY_TEXTURE2D]
D3D11 INFO: Destroy ID3D11DepthStencilState: Name="unnamed", Addr=0x0000026DF802C1B0 [ STATE_CREATION INFO #2097275: DESTROY_DEPTHSTENCILSTATE]
D3D11 INFO: Destroy ID3D11RasterizerState: Name="unnamed", Addr=0x0000026DF8007C90 [ STATE_CREATION INFO #2097278: DESTROY_RASTERIZERSTATE]
D3D11 INFO: Destroy ID3D11DepthStencilState: Name="unnamed", Addr=0x0000026DF808E6E0 [ STATE_CREATION INFO #2097275: DESTROY_DEPTHSTENCILSTATE]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x0000026DF8039790 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x0000026DF803E180 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11VertexShader: Name="unnamed", Addr=0x0000026DF7F65F10 [ STATE_CREATION INFO #2097251: DESTROY_VERTEXSHADER]
D3D11 INFO: Destroy ID3D11InputLayout: Name="unnamed", Addr=0x0000026DF7F890C0 [ STATE_CREATION INFO #2097266: DESTROY_INPUTLAYOUT]
D3D11 INFO: Destroy ID3D11Buffer: Name="unnamed", Addr=0x0000026DF8066220 [ STATE_CREATION INFO #2097230: DESTROY_BUFFER]
D3D11 INFO: Destroy ID3D11PixelShader: Name="unnamed", Addr=0x0000026DF8041EB0 [ STATE_CREATION INFO #2097263: DESTROY_PIXELSHADER]
D3D11 INFO: Destroy ID3D11ShaderResourceView: Name="unnamed", Addr=0x0000026DF8033750 [ STATE_CREATION INFO #2097242: DESTROY_SHADERRESOURCEVIEW]
D3D11 INFO: Destroy ID3D11Texture2D: Name="unnamed", Addr=0x0000026DF802C540 [ STATE_CREATION INFO #2097236: DESTROY_TEXTURE2D]
D3D11 INFO: Destroy ID3D11Sampler: Name="unnamed", Addr=0x0000026DF80397F0 [ STATE_CREATION INFO #2097269: DESTROY_SAMPLER]
D3D11 INFO: Destroy ID3D11Sampler: Name="unnamed", Addr=0x0000026DF7F0C760 [ STATE_CREATION INFO #2097269: DESTROY_SAMPLER]
D3D11 INFO: Destroy ID3D11Context: Name="unnamed", Addr=0x0000026DF5D76F80 [ STATE_CREATION INFO #2097227: DESTROY_CONTEXT]
D3D11 INFO: Destroy ID3DDeviceContextState: Name="unnamed", Addr=0x0000026DF7F0C802 [ STATE_CREATION INFO #3145749: DESTROY_DEVICECONTEXTSTATE]
The program my_executable has exited with code 0 (0x).
```

The difference is that the execution when the exception is thrown contains the creating of a **second** ID3D11Context object. My sample application contains only the default creation of graphics objects for a Window2-based application; that is, my code does not contain anything that would create a second context. The second context is not being destroyed by whomever created it, so when the application terminates, the ID3D11Device object mDevice still has references to it.

I had hoped to continue investigating by stepping through the code line-by-line with the DXGI debugging layer enabled. The idea would be to try to determine who is creating the second context. I returned to the investigation the next day, and the exception has not occurred. For the exception to occur every run on one day to not occurring the next day on any run is, perhaps, a mystery.

As it turns out, I was finally able to have the DXGI debugging layer break when an ID3D11Context is created, and I hit the break on one of the executions of the program. The context is created inside the Present call from the swap chain,

```
// The second context is created in the \Code{mSwapChain$\rightarrow$Present} call.
void DX11Engine::DisplayColorBuffer(unsigned int syncInterval)
{
    // The swap must occur on the thread in which the device was created.
    mSwapChain->Present(syncInterval, 0);
}
```

This might be related to the IDXGIFactory::CreateSwapChain warning. I tried to use the new “flip” flags when creating the swap chain and followed the advice in the [Stack Overflow post](#), but I get warnings about the back buffer being unbound, among other warnings regarding render target handling. Apparently I need to dig into the DX11 documentation to figure out the Magic Dance.

2.2 GenerateMeshUVs Sample Results Incorrect with NVIDIA DX11 Driver

October 25, 2020. When running the sample GeometricTools/GTE/Samples/Geometrics/GenerateMeshUVs from GTE5.2 on Microsoft Windows 10 using the DX11 Debug configuration, an exception is thrown,

```
GTE ERROR: File: <my_path>/GeometricTools/GTE/Mathematics/BSNumber.h Func: gte::BSNumber<class
gte::UIntegerAP32>::ConvertFrom Line: 850 BSNumber does not have a representation for
NaNs.
```

The problem occurs because of the texture coordinate generation in the HLSL shader of GPUGenerateMeshUV. The returned coordinates are all NaNs (-nan(ind)). When running the same sample is executed with GENERATE_MESH_UVS_CPU_SINGLE_THREADED rather than GENERATE_MESH_UVS_GPU, the program runs correctly. When executing the OpenGL version in Debug, the program displays what appears to be the correct mesh, but generates some messages to std::cout regarding failed PlanarMesh::GetContainingTriangle queries. The number of such failures varies with execution, which argues there is nondeterministic behavior. When I wrote this code originally, I did not observe any such behavior.

I modified the sample to use float rather than double, but the exception still occurs. This argues that the HLSL code might be incorrectly compiled and/or optimized.

The NVIDIA driver version is 451.67 running on a machine with a GeForce RTX 2080 Super.

2.3 Debug Performance with MSVS 16.7 and Later

August 14, 2020. Microsoft Visual Studio 16.7.* uses a new C++ Standard Library implementation. Dinkumware was the implementation of choice for a long time, now the <array> header file has a comment *SPDX-License-Identifier: Apache-2.0 WITH LLVM-exception*. The Debug performance for some of my code has decreased significantly. In particular, the ETManifoldMesh class uses std::map with a key-type of EdgeKey. The latter class derives from FeatureKey, which stores the vertex indices in a std::array object. FeatureKey also implements comparison operators that directly call the std::array comparisons. These in turn lead to calls to lexicographical_compare that show up as the main bottleneck when using ETManifoldMesh. By bottleneck, I mean significant bottleneck. I am going to eliminate the std::array comparisons in my code, but I do not yet

know what other performance problems might occur. If you encounter performance problems related to the new C++ Standard Library, send me email so I can investigate it and fix it.

2.4 Reference Counting Bug in Inter Compiler 19.0

February 19, 2020. The Intel Compiler 19.0, in conjunction with changes made to <memory> in Microsoft Visual Studio's C++ Standard Library starting with version 16.4.4, has a serious bug. When enabled as the compiler in the MSVS IDE, the Intel compiler incorrectly compiles constructor code for `std::shared_ptr` objects. This leads to memory leaks and to random crashes that are caused by premature deletion of objects. The Intel compiler is incorrectly generating code for

```
constexpr _Ref_count_base() noexcept = default;
```

where it sets `_Weaks` to 0 rather than to 1. A quick fix is to modify the Microsoft header file, changing the constructor to

```
_Ref_count_base(): _Uses(1), _Weaks(1){}
```

For more information see [Intel Compiler Forum post](#). The Intel Compiler 19.1 has the fix to this problem and correctly compiles the code.

2.5 Compiler Failure in a Windows 10 SDK Header File

January 13, 2020. When compiling with Microsoft Visual Studio on a Microsoft Windows 10 machine, the projects are set up to use the latest installed version of the Windows 10 SDK. If your machine's latest version is 10.0.17763.0, the file `GeometricTools/GTE/Applications/MSW/WICFileIO.cpp` will compile in Debug configuration but will not compile in Release configuration. The error messages are for `module.h` in the SDK, claiming that the function `Details::CheckForDuplicateEntries` does not exist in the `Details` namespace. This is a bug in `module.h`. The declaration of `CheckForDuplicateEntries` occurs in the namespace `Details` and is contained in a conditionally compiled block when `_DEBUG` is defined. However, the definitions for `CheckForDuplicateEntries` are not contained in a conditionally compiled block when they should be. This has been fixed in Windows SDK version 10.0.18362.0. You can install the newer Windows SDK version by using the Visual Studio Installer, selecting the `Modify` option, selecting the item `Individual Components`, checking the box for the Windows SDK version 10.0.18362.0 and then pressing the `Modify` button in the lower right of the installer window.