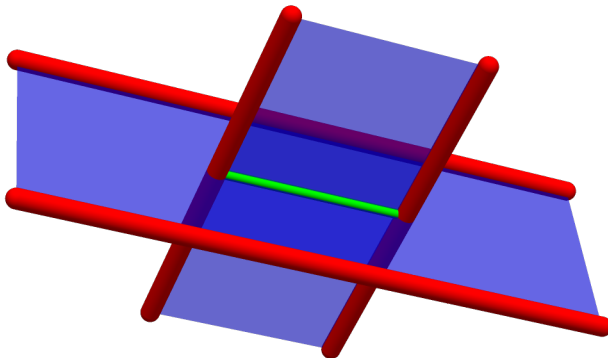


Pensieve header: Ribbon drawings continuing pensieve://2015-07/PolyPoly/ and pensieve://Projects/Killam-2017/.

```
In[ ]:= SetDirectory["C:\\drorbn\\AcademicPensieve\\Projects\\RibbonKnots"];
```

```
In[ ]:= ribbon = Graphics3D[
  {
    Green, Tube[{{-1, 0, 0}, {1, 0, 0}}, 0.05],
    Red,
    Tube[{{-3, 1, 0}, {3, 1, 0}}, 0.1], Tube[{{3, -1, 0}, {-3, -1, 0}}, 0.1],
    Tube[{{-1, 0, -2}, {-1, 0, 2}}, 0.1], Tube[{{1, 0, 2}, {1, 0, -2}}, 0.1],
    Opacity[0.6], Blue, EdgeForm[None],
    Polygon[{{-3, 1, 0}, {3, 1, 0}, {3, -1, 0}, {-3, -1, 0}}],
    Polygon[{{-1, 0, -2}, {-1, 0, 2}, {1, 0, 2}, {1, 0, -2}}]
  },
  Boxed → False, ViewPoint → {-1.05544, -2.48236, 2.04302},
  ViewVertical → {-0.355079, 0.320399, 1.36975}
]
```

Out[ ]=

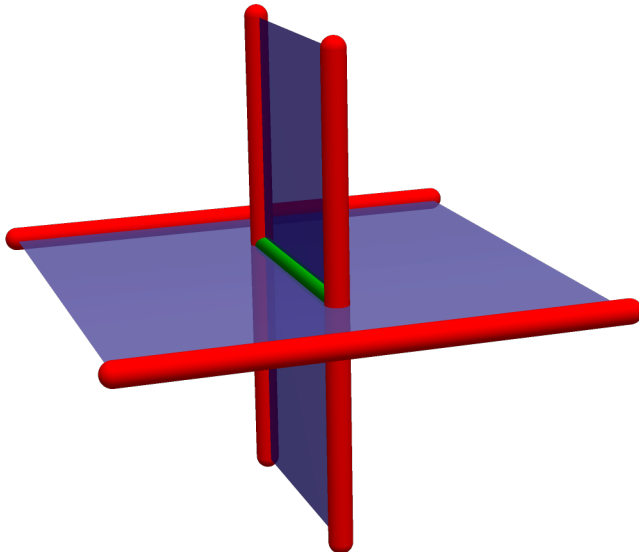


```

In[ ]:= ribbon2 = Graphics3D[
  {
    Green, Tube[{{0, -1, 0}, {0, 1, 0}}, 0.08],
    Red, Tube[{{-2, 2, 0}, {2, 2, 0}}, 0.1], Tube[{{2, -2, 0}, {-2, -2, 0}}, 0.1],
    Red, Tube[{{0, -1, -2}, {0, -1, 2}}, 0.1], Tube[{{0, 1, 2}, {0, 1, -2}}, 0.1],
    Opacity[0.8], Blue, EdgeForm[None], Specularity[1],
    Polygon[{{-2, 2, 0}, {2, 2, 0}, {2, -2, 0}, {-2, -2, 0}}],
    Polygon[{{0, -1, -2}, {0, -1, 2}, {0, 1, 2}, {0, 1, -2}}]
  },
  Boxed → False,
  ViewPoint → {-0.991586, -3.10187, 0.919339},
  ViewVertical → {-0.0564272, -0.237344, 0.969785}
]

```

Out[ ]=



```

In[ ]:= Export["../Discovery-2024/figs/RibbonSingularity.pdf", ImageCrop@ribbon2]

```

Out[ ]=

```

../Discovery-2024/figs/RibbonSingularity.pdf

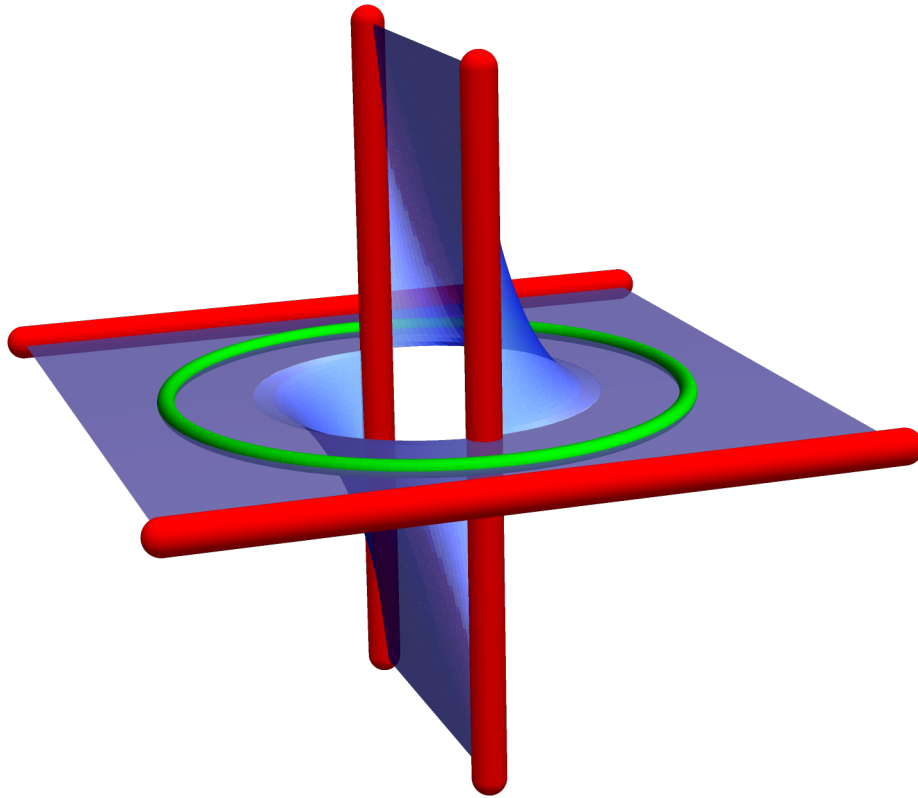
```

```

In[*]:= dz = 1 / 32; dθ = π / 64;
Seifert4Ribbon = Graphics3D[
{
  Red, Tube[{{-2, 2, 0}, {2, 2, 0}}, 0.1], Tube[{{2, -2, 0}, {-2, -2, 0}}, 0.1],
  Red, Tube[{{0, -1, -2}, {0, -1, 2}}, 0.1], Tube[{{0, 1, 2}, {0, 1, -2}}, 0.1],
  Green, Tube[Table[{1.5 Cos[θ], 1.5 Sin[θ], 0}, {θ, 0, 2 π, dθ}], 0.05],
  Opacity[0.8], Blue, EdgeForm[None], Specularity[1],
  DiscretizeRegion@RegionDifference[
    Polygon[{{-2, 2, 0}, {2, 2, 0}, {2, -2, 0}, {-2, -2, 0}}],
    Ball[]
  ],
  λ[z_, θ_] := {Max[0, 1 - √(z/2)] Sin[θ], Cos[θ], z};
  Table[
    Polygon[{λ[z, θ], λ[z + dz, θ], λ[z + dz, θ + dθ], λ[z, θ + dθ]},
      {z, 0, 2 - dz, dz}, {θ, 0, π - dθ, dθ}
    ],
  λ[z_, θ_] := {-Max[0, 1 - √(z/2)] Sin[θ], Cos[θ], -z};
  Table[
    Polygon[{λ[z, θ], λ[z + dz, θ], λ[z + dz, θ + dθ], λ[z, θ + dθ]},
      {z, 0, 2 - dz, dz}, {θ, 0, π - dθ, dθ}
    ]
  ],
  Boxed → False,
  ViewPoint → {-0.991586, -3.10187, 0.919339},
  ViewVertical → {-0.0564272, -0.237344, 0.969785}
]

```

Out[\*]=



```
In[*]:= Export["../Discovery-2024/figs/Seifert4Ribbon.pdf", ImageCrop@Seifert4Ribbon]
```

Out[\*]=

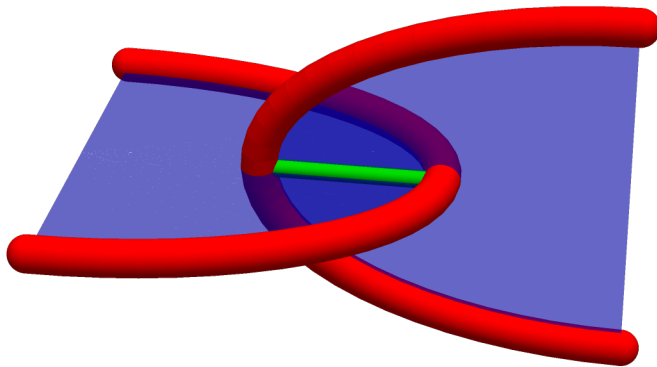
```
../Discovery-2024/figs/Seifert4Ribbon.pdf
```

```

In[ ]:= dt =  $\pi / 32$ ;
 $\gamma_1[t\_]$  := {2 Cos[t] - 3/2, Sin[t], 0};
 $\gamma_2[t\_]$  := {3/2 - 2 Cos[t], 0, Sin[t]};
clasp = Graphics3D[
  {
    Green, Tube[{{-1/2, 0, 0}, {1/2, 0, 0}}, 0.05],
    Red,
    Tube[Table[ $\gamma_1[t]$ , {t, - $\pi/2$ ,  $\pi/2$ , dt}], 0.1],
    Tube[Table[ $\gamma_2[t]$ , {t, - $\pi/2$ ,  $\pi/2$ , dt}], 0.1],
    Opacity[0.6], Blue, EdgeForm[None],
    Table[Polygon[{{-3/2, 0, 0},  $\gamma_1[t]$ ,  $\gamma_1[t + dt]$ }], {t, - $\pi/2$ ,  $\pi/2 - dt$ , dt}],
    Table[Polygon[{{3/2, 0, 0},  $\gamma_2[t]$ ,  $\gamma_2[t + dt]$ }], {t, - $\pi/2$ ,  $\pi/2 - dt$ , dt}]
  ],
  Boxed  $\rightarrow$  False, ViewPoint  $\rightarrow$  {0.530012, -2.81796, 1.79672},
  ViewVertical  $\rightarrow$  {0.0301724, -0.099258, 1.45049}
]

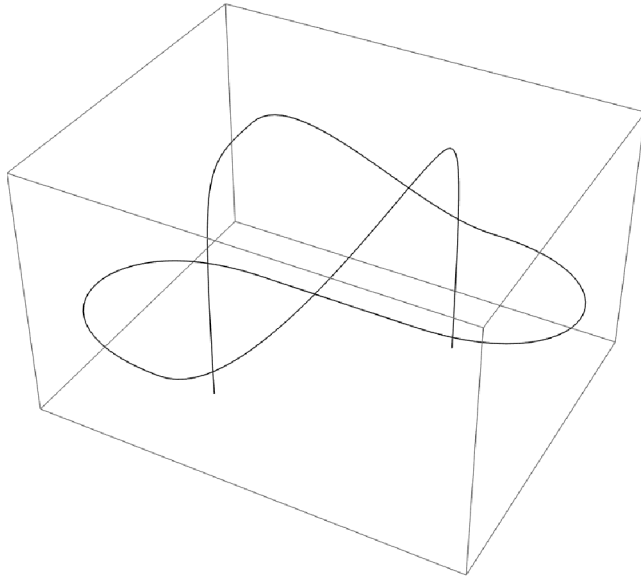
```

Out[ ]=



```
In[ ]:= pts = {  
  {-1, -1, 0}, {-1, -1, 3},  
  {-1, -1, 3}, {-1, 0, 3}, {-1, 1, 3},  
  {0, 2, 1}, {1, 2, 1}, {3, 2, 1},  
  {3, 0, 1}, {1, 0, 1}, {0, 0, 1}  
};  
pts = Join[pts, Reverse[pts /. {x_, y_, z_} => {-x, -y, z}]];  
Graphics3D[BezierCurve[pts]] // Rasterize
```

Out[ ]:=

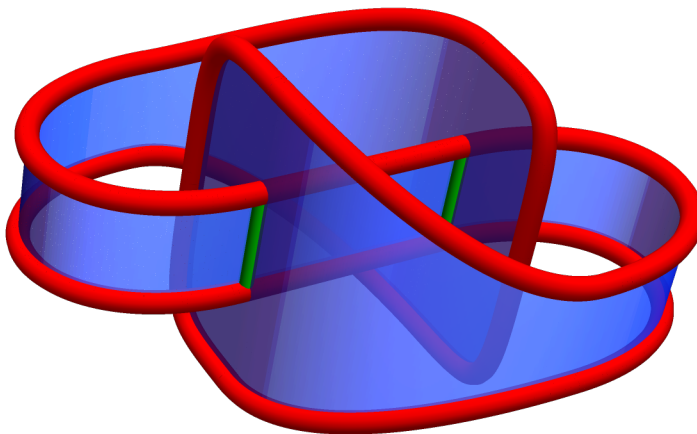


```

In[*]:= zs = 0.5;
γs = BezierFunction /@Partition[pts /. {x_, y_, z_} => {x, y, z*zs}, 4, 3];
dt = 1/120; r = 0.1;
RibbonKnot = Graphics3D[{
  Green,
  Tube[{{-1, 0, -zs}, {-1, 0, zs}}, r/1.5],
  Tube[{{1, 0, -zs}, {1, 0, zs}}, r/1.5],
  Red, CapForm[None],
  Table[{
    Tube[Table[γ[t], {t, 0, 1, dt}], r],
    Tube[Table[γ[t]*{1, 1, -1}, {t, 0, 1, dt}], r]
  }, {γ, γs}],
  Opacity[0.8], Blue, EdgeForm[None], Specularity[1],
  Table[
    Polygon[{γ[t], γ[t+dt], {1, 1, -1}*γ[t+dt], {1, 1, -1}*γ[t]},
    {γ, γs}, {t, 0, 1-dt, dt}
  ]
}, Boxed -> False, ViewPoint -> {1.73822, -2.13894, -1.96304},
ViewVertical -> {0.498569, -0.732403, -1.02979}]

```

Out[\*]=



```

In[*]:= Export["../Discovery-2024/figs/RibbonKnot.pdf", ImageCrop@RibbonKnot]

```

Out[\*]=

```

../Discovery-2024/figs/RibbonKnot.pdf

```