In[1]:=
```
SetDirectory["C:/drorbn/AcademicPensieve/2012-06/Regina_Talk/"]
```

Out[1]=
```
C:\drorbn\AcademicPensieve\2012-06\Regina_Talk
```

StandardAlexander

In[2]:=

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & X-1 & 0 & -X \\ -1 & X & 0 & 0 & 0 & 0 & 1-X & 0 \\ 0 & -1 & X & 0 & 1-X & 0 & 0 & 0 \\ X-1 & 0 & -X & 1 & 0 & 0 & 0 & 0 \\ 0 & 1-X & 0 & -1 & X & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -X & 1 & 0 & X-1 \\ 0 & 0 & 1-X & 0 & 0 & -1 & X & 0 \\ 0 & 0 & 0 & X-1 & 0 & 0 & -X & 1 \end{pmatrix} [[1 ;; 7, 1 ;; 7]] \text{ // Det}$$

StandardAlexander

Out[2]= $-1+4X-8X^2+11X^3-8X^4+4X^5-X^6$

Initialization

In[3]:=
```
βSimp = Factor; SetAttributes[βCollect, Listable];
βCollect[B[ω_, Λ_]] := B[βSimp[ω],
   Collect[Λ, h_, Collect[#, t_, βSimp] &]];
βForm[B[ω_, Λ_]] := Module[{ts, hs, M},
   ts = Union[Cases[B[ω, Λ], t_s_ :→ s, Infinity]];
   hs = Union[Cases[B[ω, Λ], h_s_ :→ s, Infinity]];
   M = Outer[βSimp[Coefficient[Λ, h_#1 t_#2]] &, hs, ts];
   PrependTo[M, t_# & /@ ts];
   M = Prepend[Transpose[M], Prepend[h_# & /@ hs, ω]];
   MatrixForm[M]];
βForm[else_] := else /. β_B :→ βForm[β];
Format[β_B, StandardForm] := βForm[β];
```

Program

In[8]:=
```
⟨μ_⟩ := μ /. t_ → 1;
tm_{x_,y_→z_}[β_] := βCollect[β /. t_{x|y} → t_z];
hm_{x_,y_→z_}[B[ω_, Λ_]] := Module[
   {α = D[Λ, h_x], β = D[Λ, h_y], γ = Λ /. h_{x|y} → 0},
   B[ω, (α + (1 + ⟨α⟩) β) h_z + γ] // βCollect];
sw_{x_,y_}[B[ω_, Λ_]] := Module[{α, β, γ, δ, ϵ},
   α = Coefficient[Λ, h_y t_x]; β = D[Λ, t_x] /. h_y → 0;
   γ = D[Λ, h_y] /. t_x → 0;   δ = Λ /. h_y | t_x → 0;
   ϵ = 1 + α;
   B[ω * ϵ, α (1 + ⟨γ⟩ / ϵ) h_y t_x + β (1 + ⟨γ⟩ / ϵ) t_x
         + γ / ϵ h_y             + δ - γ * β / ϵ
    ] // βCollect];
gm_{x_,y_→z_}[β_] := β // sw_{xy} // hm_{xy→z} // tm_{xy→z};
B /: B[ω1_, Λ1_] B[ω2_, Λ2_] := B[ω1 * ω2, Λ1 + Λ2];
Rp_{x_,y_} := B[1, (X - 1) t_x h_y];
Rm_{x_,y_} := B[1, (X^-1 - 1) t_x h_y];
```

htt

In[16]:= $\left\{\beta = \mathbf{B}\left[\omega,\ \mathbf{Sum}\left[\alpha_{10\,i+j}\,t_i\,h_j,\ \{i, \{1, 2, 3\}\},\ \{j, \{4, 5\}\}\right]\right],\ (\beta \,//\, tm_{12\to 1} \,//\, sw_{14}) == (\beta \,//\, sw_{24} \,//\, sw_{14} \,//\, tm_{12\to 1})\right\}$

htt

Out[16]= $\left\{\begin{pmatrix} \omega & h_4 & h_5 \\ t_1 & \alpha_{14} & \alpha_{15} \\ t_2 & \alpha_{24} & \alpha_{25} \\ t_3 & \alpha_{34} & \alpha_{35} \end{pmatrix}, \text{True}\right\}$

R3

In[17]:= $\{Rm_{51}\,Rm_{62}\,Rp_{34} \,//\, gm_{14\to 1} \,//\, gm_{25\to 2} \,//\, gm_{36\to 3},\ Rp_{61}\,Rm_{24}\,Rm_{35} \,//\, gm_{14\to 1} \,//\, gm_{25\to 2} \,//\, gm_{36\to 3}\}$

R3

Out[17]= $\left\{\begin{pmatrix} 1 & h_1 & h_2 \\ t_2 & -\frac{-1+X}{X} & 0 \\ t_3 & \frac{-1+X}{X} & -\frac{-1+X}{X} \end{pmatrix}, \begin{pmatrix} 1 & h_1 & h_2 \\ t_2 & -\frac{-1+X}{X} & 0 \\ t_3 & \frac{-1+X}{X} & -\frac{-1+X}{X} \end{pmatrix}\right\}$

8_17-1

In[18]:= $\beta = Rm_{12,1}\,Rm_{27}\,Rm_{83}\,Rm_{4,11}\,Rp_{16,5}\,Rp_{6,13}\,Rp_{14,9}\,Rp_{10,15}$

8_17-1

Out[18]=
$$\begin{pmatrix} 1 & h_1 & h_3 & h_5 & h_7 & h_9 & h_{11} & h_{13} & h_{15} \\ t_2 & 0 & 0 & 0 & -\frac{-1+X}{X} & 0 & 0 & 0 & 0 \\ t_4 & 0 & 0 & 0 & 0 & 0 & -\frac{-1+X}{X} & 0 & 0 \\ t_6 & 0 & 0 & 0 & 0 & 0 & 0 & -1+X & 0 \\ t_8 & 0 & -\frac{-1+X}{X} & 0 & 0 & 0 & 0 & 0 & 0 \\ t_{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1+X \\ t_{12} & -\frac{-1+X}{X} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ t_{14} & 0 & 0 & 0 & 0 & -1+X & 0 & 0 & 0 \\ t_{16} & 0 & 0 & -1+X & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

8_17-2

In[19]:= $\mathbf{Do}[\beta = \beta \,//\, gm_{1k\to 1},\ \{k, 2, 10\}];\ \beta$

8_17-2

Out[19]=
$$\begin{pmatrix} \frac{1}{X} & h_1 & h_{11} & h_{13} & h_{15} \\ t_1 & -\frac{(-1+X)(1+X)}{X} & -(-1+X)(1-X+X^2) & (-1+X)(1-X+X^2) & -1+X \\ t_{12} & -\frac{-1+X}{X} & 0 & 0 & 0 \\ t_{14} & -1+X & \frac{(-1+X)^2(1-X+X^2)}{X} & -\frac{(-1+X)^2(1-X+X^2)}{X} & 0 \\ t_{16} & \frac{-1+X}{X} & (-1+X)^2 & -\frac{(-1+X)^3}{X} & 0 \end{pmatrix}$$

8_17-3

In[20]:= $\mathbf{Do}[\beta = \beta \,//\, gm_{1k\to 1},\ \{k, 11, 16\}];\ \beta$

8_17-3

Out[20]= $\left(-\frac{1-4X+8X^2-11X^3+8X^4-4X^5+X^6}{X^3}\right)$