

In[12]:= ? LieMorphism*

▼ Global

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|------------------|------------------|------------------|------------------|-----------------|
| LieMorphism | LieMorphism\$285 | LieMorphism\$298 | LieMorphism\$351 | LieMorphism\$97 |
| LieMorphism\$110 | LieMorphism\$288 | LieMorphism\$307 | LieMorphism\$353 | |

Global`LieMorphism

LieMorphism[{Defer[⟨2⟩] → LieSeries[Defer[⟨5⟩]]}] = LieMorphism\$353

LieMorphism[{Defer[⟨2⟩] → LieSeries[Defer[⟨5⟩], -Defer[⟨15⟩]]}] = LieMorphism\$351

LieMorphism[{Defer[⟨1⟩] → Defer[⟨2⟩], Defer[⟨2⟩] → Defer[⟨2⟩]}] = LieMorphism\$97

LieMorphism[{Defer[⟨x⟩] → LieSeries[Defer[⟨1⟩]], Defer[⟨y⟩] → LieSeries[Defer[⟨2⟩]]}] = LieMorphism\$307

LieMorphism[{Defer[⟨x⟩] → LieSeries[Defer[⟨1⟩], 0],
Defer[⟨y⟩] → LieSeries[Defer[⟨2⟩], 0]}] = LieMorphism\$298

LieMorphism[{Defer[⟨x⟩] → LieSeries[Defer[⟨1⟩], 0, 0],
Defer[⟨y⟩] → LieSeries[Defer[⟨2⟩], 0, 0]}] = LieMorphism\$288

LieMorphism[{Defer[⟨x⟩] → LieSeries[Defer[⟨1⟩], 0, 0, 0],
Defer[⟨y⟩] → LieSeries[Defer[⟨2⟩], 0, 0, 0]}] = LieMorphism\$285

LieMorphism[{Defer[⟨x⟩] → LieSeries[Defer[⟨1⟩], 0, 0, 0, 0],
Defer[⟨y⟩] → LieSeries[Defer[⟨2⟩], 0, 0, 0, 0]}] = LieMorphism\$110

LieMorphism[rules_List] := LieMorphism[rules] = LieMorphism[Unique[LieMorphism], rules]

LieMorphism[mor_Symbol, rules_List] :=
(mor[] = rules; mor[w_LW] /; Deg[w] == 1 := mor[w] = w /. rules;
mor[w_LW] := mor[w] = b@@mor /@LyndonFactorization[w];
mor[s_LieSeries] := Module[{l = Length[s]},
MakeLieSeries[1, \sum_k^l LieMorphism[MakeLieSeries[l - k + 1, rules]] [s[[k]]]]];
mor[expr_] := Expand[expr /. {s_LieSeries -> mor[s], w_LW -> mor[w]}]; mor)

In[13]:= $\mu = h[3] \text{LieSeries}[\langle "1" \rangle, 0, 0, 0, 0] + h[4] \text{LieSeries}[\langle "2" \rangle, 0, 0, 0, 0]$

Out[13]= $h[3] \text{LieSeries}[\langle 1 \rangle, 0, 0, 0, 0] + h[4] \text{LieSeries}[\langle 2 \rangle, 0, 0, 0, 0]$

In[14]:= {x, y, z} = {3, 2, 5}

Out[14]= {3, 2, 5}

In[15]:= Ad[D[μ , h[x]]][LW[z]]

Out[15]= LieSeries[⟨5⟩, -⟨15⟩]

In[24]:= a1 = D[μ , h[x]]

Out[24]= LieSeries[⟨1⟩, 0, 0, 0, 0]

In[25]:= a2 = LW[z]

Out[25]= ⟨5⟩

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In[26]:= Ad[D[μ, h[x]]]
Out[26]= OperatorSeries[e-ad, ad → ad[LieSeries[⟨1⟩, 0, 0, 0, 0]], 4]
In[27]:= Ad[D[μ, h[x]]][MakeLieSeries[5, LW[z]]]
Out[27]= LieSeries[⟨5⟩, -⟨15⟩,  $\frac{\langle 115 \rangle}{2}$ ,  $-\frac{\langle 1115 \rangle}{6}$ ,  $\frac{\langle 11115 \rangle}{24}$ ]
In[29]:= a2 // ad[a1]
Out[29]= LieSeries[0, ⟨15⟩]
In[51]:= a2 // ad[a1] // ad[a1]
Out[51]= LieSeries[0, 0, ⟨115⟩, 0, 0, 0, 0]
In[50]:= b[LieSeries[⟨"1"⟩, 0, 0, 0, 0], ⟨"5"⟩]
Out[50]= LieSeries[0, ⟨15⟩, 0, 0, 0, 0]

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