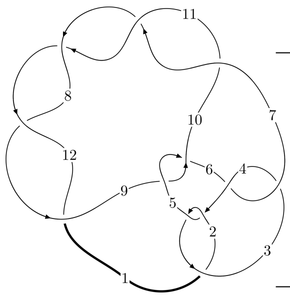
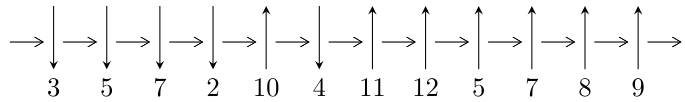
# $12n_{0115}$ ($K12n_{0115}$)




A knot diagram[1]

**Linearized knot diagam**




**Solving Sequence**

$$7,10 \xrightarrow[c_{10}]{} 11 \xrightarrow[c_7]{} 8 \xrightarrow[c_{11}]{} 4,12 \xrightarrow[c_3]{} 3 \xrightarrow[c_6]{} 6 \xrightarrow[c_5]{} 5 \xrightarrow[c_2]{} 2 \xrightarrow[c_1]{} 1 \xrightarrow[c_9]{} 9 \twoheadrightarrow c_4, c_8, c_{12}$$

**Ideals for irreducible components[2] of $X_{\mathbf{par}}$**

$$I_1^u = \langle 152u^{13} - 2309u^{12} + \cdots + 4348b + 7399,\ -4859u^{13} + 22201u^{12} + \cdots + 4348a - 33463,$$
$$u^{14} - 5u^{13} + 5u^{12} + 10u^{11} - 13u^{10} - 15u^9 - 5u^8 + 77u^7 - 45u^6 - 64u^5 + 60u^4 + 21u^3 - 41u^2 + 14u - 1\rangle$$
$$I_2^u = \langle 2a^2u - a^2 + au + b - a + 2u,\ a^3 - a^2u - a^2 + 2au + 4a - 2u - 3,\ u^2 + u - 1\rangle$$
$$I_3^u = \langle u^2 + b - u - 2,\ a,\ u^3 - u^2 - 2u + 1\rangle$$

* 3 irreducible components of $\dim_{\mathbb{C}} = 0$, with total 23 representations.

[1]The image of knot diagram is generated by the software "**Draw programme**" developed by Andrew Bartholomew(`http://www.layer8.co.uk/maths/draw/index.htm#Running-draw`), where we modified some parts for our purpose(`https://github.com/CATsTAILs/LinksPainter`).

[2]All coefficients of polynomials are rational numbers. But the coefficients are sometimes approximated in decimal forms when there is not enough margin.

**I.** $\boldsymbol{I_1^u = \langle 152u^{13} - 2309u^{12} + \cdots + 4348b + 7399,\ -4859u^{13} + 22201u^{12} + \cdots + 4348a - 33463,\ u^{14} - 5u^{13} + \cdots + 14u - 1\rangle}$

**(i) Arc colorings**

$$a_7 = \begin{pmatrix} 0 \\ u \end{pmatrix}$$
$$a_{10} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$
$$a_{11} = \begin{pmatrix} 1 \\ -u^2 \end{pmatrix}$$
$$a_8 = \begin{pmatrix} u \\ -u^3 + u \end{pmatrix}$$
$$a_4 = \begin{pmatrix} 1.11753u^{13} - 5.10603u^{12} + \cdots - 32.0340u + 7.69618 \\ -0.0349586u^{13} + 0.531049u^{12} + \cdots + 9.42157u - 1.70170 \end{pmatrix}$$
$$a_{12} = \begin{pmatrix} -u^2 + 1 \\ u^4 - 2u^2 \end{pmatrix}$$
$$a_3 = \begin{pmatrix} 1.11753u^{13} - 5.10603u^{12} + \cdots - 32.0340u + 7.69618 \\ -0.393514u^{13} + 2.11431u^{12} + \cdots + 15.0465u - 2.18330 \end{pmatrix}$$
$$a_6 = \begin{pmatrix} 0.332567u^{13} - 1.32498u^{12} + \cdots - 10.1125u + 3.24448 \\ -0.299908u^{13} + 1.56900u^{12} + \cdots + 9.10350u - 1.05934 \end{pmatrix}$$
$$a_5 = \begin{pmatrix} 0.632475u^{13} - 2.89397u^{12} + \cdots - 19.2160u + 4.30382 \\ -0.299908u^{13} + 1.56900u^{12} + \cdots + 9.10350u - 1.05934 \end{pmatrix}$$
$$a_2 = \begin{pmatrix} 0.632475u^{13} - 2.89397u^{12} + \cdots - 19.2160u + 4.30382 \\ 0.00666973u^{13} + 0.252300u^{12} + \cdots + 7.25345u - 1.30198 \end{pmatrix}$$
$$a_1 = \begin{pmatrix} -u^4 + 3u^2 - 1 \\ u^6 - 4u^4 + 3u^2 \end{pmatrix}$$
$$a_9 = \begin{pmatrix} -u^3 + 2u \\ u^5 - 3u^3 + u \end{pmatrix}$$

**(ii) Obstruction class** $= -1$

**(iii) Cusp Shapes** $= -\frac{11021}{2174}u^{13} + \frac{53061}{2174}u^{12} + \cdots + \frac{369277}{2174}u - \frac{54785}{2174}$

**(iv) u-Polynomials at the component**

| Crossings | u-Polynomials at each crossing |
|---|---|
| $c_1$ | $u^{14} + 18u^{13} + \cdots + 1086u + 1$ |
| $c_2, c_4$ | $u^{14} - 6u^{13} + \cdots - 34u - 1$ |
| $c_3, c_6$ | $u^{14} - 3u^{13} + \cdots - 28u + 8$ |
| $c_5, c_9$ | $u^{14} + 2u^{13} + \cdots + 352u + 64$ |
| $c_7, c_8, c_{10}$ $c_{11}, c_{12}$ | $u^{14} - 5u^{13} + \cdots + 14u - 1$ |

**(v) Riley Polynomials at the component**

| Crossings | Riley Polynomials at each crossing |
|---|---|
| $c_1$ | $y^{14} - 38y^{13} + \cdots - 1163634y + 1$ |
| $c_2, c_4$ | $y^{14} - 18y^{13} + \cdots - 1086y + 1$ |
| $c_3, c_6$ | $y^{14} - 15y^{13} + \cdots - 2512y + 64$ |
| $c_5, c_9$ | $y^{14} + 30y^{13} + \cdots - 87040y + 4096$ |
| $c_7, c_8, c_{10}$ $c_{11}, c_{12}$ | $y^{14} - 15y^{13} + \cdots - 114y + 1$ |

**(vi) Complex Volumes and Cusp Shapes**

| Solutions to $I_1^u$ | $\sqrt{-1}(\mathrm{vol}+\sqrt{-1}CS)$ | Cusp shape |
|---|---|---|
| $u = -0.847247 + 0.340274I$<br>$a = -1.07919 + 1.10825I$<br>$b = -0.214655 + 0.076845I$ | $4.35404 + 2.18891I$ | $7.66563 + 1.41199I$ |
| $u = -0.847247 - 0.340274I$<br>$a = -1.07919 - 1.10825I$<br>$b = -0.214655 - 0.076845I$ | $4.35404 - 2.18891I$ | $7.66563 - 1.41199I$ |
| $u = 0.683451 + 0.439394I$<br>$a = -0.372092 - 1.119180I$<br>$b = -0.54173 - 1.61181I$ | $-1.117970 + 0.457834I$ | $6.03602 - 2.75865I$ |
| $u = 0.683451 - 0.439394I$<br>$a = -0.372092 + 1.119180I$<br>$b = -0.54173 + 1.61181I$ | $-1.117970 - 0.457834I$ | $6.03602 + 2.75865I$ |
| $u = 1.293890 + 0.440522I$<br>$a = 0.947194 - 0.804395I$<br>$b = -0.03997 - 1.45852I$ | $1.31890 + 3.26489I$ | $6.50646 - 2.86357I$ |
| $u = 1.293890 - 0.440522I$<br>$a = 0.947194 + 0.804395I$<br>$b = -0.03997 + 1.45852I$ | $1.31890 - 3.26489I$ | $6.50646 + 2.86357I$ |
| $u = -0.79945 + 1.23640I$<br>$a = 0.51219 + 1.76331I$<br>$b = -0.10570 + 1.90296I$ | $-13.41460 - 4.06288I$ | $3.37939 + 1.99626I$ |
| $u = -0.79945 - 1.23640I$<br>$a = 0.51219 - 1.76331I$<br>$b = -0.10570 - 1.90296I$ | $-13.41460 + 4.06288I$ | $3.37939 - 1.99626I$ |
| $u = 0.485579$<br>$a = -0.359180$<br>$b = 0.426392$ | 0.739738 | 13.5200 |
| $u = -1.59630$<br>$a = 0.385525$<br>$b = -1.79529$ | 7.97868 | 20.7070 |

| Solutions to $I_1^u$ | $\sqrt{-1}(\mathrm{vol}+\sqrt{-1}CS)$ | Cusp shape |
|---|---|---|
| $u = 1.74684 + 0.37580I$<br>$a = -0.709908 + 0.913168I$<br>$b = 0.34316 + 1.93469I$ | $-5.06340 + 10.16720I$ | $5.53186 - 3.95031I$ |
| $u = 1.74684 - 0.37580I$<br>$a = -0.709908 - 0.913168I$<br>$b = 0.34316 - 1.93469I$ | $-5.06340 - 10.16720I$ | $5.53186 + 3.95031I$ |
| $u = 1.85818$<br>$a = 0.512193$<br>$b = 0.340829$ | $15.4110$ | $1.86040$ |
| $u = 0.0975686$<br>$a = 4.86506$<br>$b = -0.854160$ | $-1.21825$ | $-10.3270$ |

**II.**

$$\boldsymbol{I_2^u = \langle 2a^2u - a^2 + au + b - a + 2u,\ a^3 - a^2u - a^2 + 2au + 4a - 2u - 3,\ u^2 + u - 1\rangle}$$

**(i) Arc colorings**

$$a_7 = \begin{pmatrix} 0 \\ u \end{pmatrix}$$

$$a_{10} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$a_{11} = \begin{pmatrix} 1 \\ u - 1 \end{pmatrix}$$

$$a_8 = \begin{pmatrix} u \\ -u + 1 \end{pmatrix}$$

$$a_4 = \begin{pmatrix} a \\ -2a^2u + a^2 - au + a - 2u \end{pmatrix}$$

$$a_{12} = \begin{pmatrix} u \\ -u \end{pmatrix}$$

$$a_3 = \begin{pmatrix} a \\ -2a^2u + a^2 - 2u \end{pmatrix}$$

$$a_6 = \begin{pmatrix} a^2u \\ 0 \end{pmatrix}$$

$$a_5 = \begin{pmatrix} a^2u \\ 0 \end{pmatrix}$$

$$a_2 = \begin{pmatrix} a^2u \\ -2a^2u + a^2 - 2u \end{pmatrix}$$

$$a_1 = \begin{pmatrix} 0 \\ -u \end{pmatrix}$$

$$a_9 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

**(ii) Obstruction class** $= 1$

**(iii) Cusp Shapes** $= 19a^2u - 13a^2 + 9au - a + 8u - 9$

**(iv) u-Polynomials at the component**

| Crossings | u-Polynomials at each crossing |
|---|---|
| $c_1, c_3$ | $(u^3 - u^2 + 2u - 1)^2$ |
| $c_2$ | $(u^3 + u^2 - 1)^2$ |
| $c_4$ | $(u^3 - u^2 + 1)^2$ |
| $c_5, c_9$ | $u^6$ |
| $c_6$ | $(u^3 + u^2 + 2u + 1)^2$ |
| $c_7, c_8$ | $(u^2 - u - 1)^3$ |
| $c_{10}, c_{11}, c_{12}$ | $(u^2 + u - 1)^3$ |

**(v) Riley Polynomials at the component**

| Crossings | Riley Polynomials at each crossing |
|---|---|
| $c_1, c_3, c_6$ | $(y^3 + 3y^2 + 2y - 1)^2$ |
| $c_2, c_4$ | $(y^3 - y^2 + 2y - 1)^2$ |
| $c_5, c_9$ | $y^6$ |
| $c_7, c_8, c_{10}$ $c_{11}, c_{12}$ | $(y^2 - 3y + 1)^3$ |

**(vi) Complex Volumes and Cusp Shapes**

| Solutions to $I_2^u$ | $\sqrt{-1}(\mathrm{vol} + \sqrt{-1}CS)$ | Cusp shape |
|---|---|---|
| $u = 0.618034$<br>$a = 0.922021$<br>$b = -1.08457$ | $-0.126494$ | $-0.918090$ |
| $u = 0.618034$<br>$a = 0.34801 + 2.11500I$<br>$b = -0.075747 + 0.460350I$ | $4.01109 - 2.82812I$ | $3.00413 + 7.79836I$ |
| $u = 0.618034$<br>$a = 0.34801 - 2.11500I$<br>$b = -0.075747 - 0.460350I$ | $4.01109 + 2.82812I$ | $3.00413 - 7.79836I$ |
| $u = -1.61803$<br>$a = -0.132927 + 0.807858I$<br>$b = 0.198308 + 1.205210I$ | $11.90680 + 2.82812I$ | $7.89941 - 3.17745I$ |
| $u = -1.61803$<br>$a = -0.132927 - 0.807858I$<br>$b = 0.198308 - 1.205210I$ | $11.90680 - 2.82812I$ | $7.89941 + 3.17745I$ |
| $u = -1.61803$<br>$a = -0.352181$<br>$b = 2.83945$ | $7.76919$ | $-21.8890$ |

**III.** $\boldsymbol{I_3^u = \langle u^2 + b - u - 2,\ a,\ u^3 - u^2 - 2u + 1\rangle}$

**(i) Arc colorings**

$$a_7 = \begin{pmatrix} 0 \\ u \end{pmatrix}$$
$$a_{10} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$
$$a_{11} = \begin{pmatrix} 1 \\ -u^2 \end{pmatrix}$$
$$a_8 = \begin{pmatrix} u \\ -u^2 - u + 1 \end{pmatrix}$$
$$a_4 = \begin{pmatrix} 0 \\ -u^2 + u + 2 \end{pmatrix}$$
$$a_{12} = \begin{pmatrix} -u^2 + 1 \\ u^2 + u - 1 \end{pmatrix}$$
$$a_3 = \begin{pmatrix} 0 \\ -u^2 + u + 2 \end{pmatrix}$$
$$a_6 = \begin{pmatrix} 0 \\ u \end{pmatrix}$$
$$a_5 = \begin{pmatrix} -u \\ u \end{pmatrix}$$
$$a_2 = \begin{pmatrix} u \\ -u^2 + 2 \end{pmatrix}$$
$$a_1 = \begin{pmatrix} u \\ -u \end{pmatrix}$$
$$a_9 = \begin{pmatrix} -u^2 + 1 \\ u^2 \end{pmatrix}$$

**(ii) Obstruction class** $= 1$

**(iii) Cusp Shapes** $= -8u^2 + 7u + 30$

**(iv) u-Polynomials at the component**

| Crossings | u-Polynomials at each crossing |
|---|---|
| $c_1, c_2$ | $(u-1)^3$ |
| $c_3, c_6$ | $u^3$ |
| $c_4$ | $(u+1)^3$ |
| $c_5, c_7, c_8$ | $u^3+u^2-2u-1$ |
| $c_9, c_{10}, c_{11}$ $c_{12}$ | $u^3-u^2-2u+1$ |

**(v) Riley Polynomials at the component**

| Crossings | Riley Polynomials at each crossing |
| --- | --- |
| $c_1, c_2, c_4$ | $(y-1)^3$ |
| $c_3, c_6$ | $y^3$ |
| $c_5, c_7, c_8$<br>$c_9, c_{10}, c_{11}$<br>$c_{12}$ | $y^3 - 5y^2 + 6y - 1$ |

**(vi) Complex Volumes and Cusp Shapes**

| Solutions to $I_3^u$ | $\sqrt{-1}(\mathrm{vol} + \sqrt{-1}CS)$ | Cusp shape |
|---|---|---|
| $u = -1.24698$<br>$a = 0$<br>$b = -0.801938$ | 4.69981 | 8.83150 |
| $u = 0.445042$<br>$a = 0$<br>$b = 2.24698$ | $-0.939962$ | 31.5310 |
| $u = 1.80194$<br>$a = 0$<br>$b = 0.554958$ | 15.9794 | 16.6380 |

## IV. u-Polynomials

| Crossings | u-Polynomials at each crossing |
|---|---|
| $c_1$ | $((u-1)^3)(u^3-u^2+2u-1)^2(u^{14}+18u^{13}+\cdots+1086u+1)$ |
| $c_2$ | $((u-1)^3)(u^3+u^2-1)^2(u^{14}-6u^{13}+\cdots-34u-1)$ |
| $c_3$ | $u^3(u^3-u^2+2u-1)^2(u^{14}-3u^{13}+\cdots-28u+8)$ |
| $c_4$ | $((u+1)^3)(u^3-u^2+1)^2(u^{14}-6u^{13}+\cdots-34u-1)$ |
| $c_5$ | $u^6(u^3+u^2-2u-1)(u^{14}+2u^{13}+\cdots+352u+64)$ |
| $c_6$ | $u^3(u^3+u^2+2u+1)^2(u^{14}-3u^{13}+\cdots-28u+8)$ |
| $c_7, c_8$ | $((u^2-u-1)^3)(u^3+u^2-2u-1)(u^{14}-5u^{13}+\cdots+14u-1)$ |
| $c_9$ | $u^6(u^3-u^2-2u+1)(u^{14}+2u^{13}+\cdots+352u+64)$ |
| $c_{10}, c_{11}, c_{12}$ | $((u^2+u-1)^3)(u^3-u^2-2u+1)(u^{14}-5u^{13}+\cdots+14u-1)$ |

**V. Riley Polynomials**

| Crossings | Riley Polynomials at each crossing |
|---|---|
| $c_1$ | $((y-1)^3)(y^3+3y^2+2y-1)^2(y^{14}-38y^{13}+\cdots-1163634y+1)$ |
| $c_2, c_4$ | $((y-1)^3)(y^3-y^2+2y-1)^2(y^{14}-18y^{13}+\cdots-1086y+1)$ |
| $c_3, c_6$ | $y^3(y^3+3y^2+2y-1)^2(y^{14}-15y^{13}+\cdots-2512y+64)$ |
| $c_5, c_9$ | $y^6(y^3-5y^2+6y-1)(y^{14}+30y^{13}+\cdots-87040y+4096)$ |
| $c_7, c_8, c_{10}$ $c_{11}, c_{12}$ | $((y^2-3y+1)^3)(y^3-5y^2+6y-1)(y^{14}-15y^{13}+\cdots-114y+1)$ |