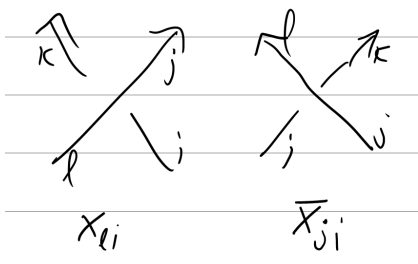


Pensieve header: The Alexander polynomial using bridges, tunnels, and Alexander numbering.

```
In[*]:= << KnotTheory`
```

Loading KnotTheory` version of February 2, 2020, 10:53:45.2097.  
Read more at <http://katlas.org/wiki/KnotTheory>.



```
In[*]:= EPD[K_] := EPD@@(PD[K] /. x : X[i_, j_, k_, l_] => If[PositiveQ[x], X_{i,j}, X_{j,i}])
```

```
In[*]:= epd = EPD@Knot[10, 165]
n = Length[epd]
```

```
Out[*]= EPD[X_{6,1}, X_{18,7}, X_{8,3}, X_{2,17}, X_{14,5}, X_{16,9}, X_{10,15}, X_{4,11}, X_{13,20}, X_{19,12}]
```

```
Out[*]= 10
```

```
In[*]:= alphaRule = betaRule = {};
epd /. X_{i,j} | X_{j,i} => (
  AppendTo[alphaRule, {i + 1 -> i, i -> i - 1}];
  AppendTo[betaRule, {j + 1 -> j, j -> j - 1}];
);
{alphaRule, betaRule}
```

```
Out[*]= {{ {7 -> 6, 6 -> 5}, {19 -> 18, 18 -> 17}, {9 -> 8, 8 -> 7}, {3 -> 2, 2 -> 1}, {15 -> 14, 14 -> 13},
  {17 -> 16, 16 -> 15}, {11 -> 10, 10 -> 9}, {5 -> 4, 4 -> 3}, {14 -> 13, 13 -> 12}, {20 -> 19, 19 -> 18} },
  {{2 -> 1, 1 -> 0}, {8 -> 7, 7 -> 6}, {4 -> 3, 3 -> 2}, {18 -> 17, 17 -> 16},
  {6 -> 5, 5 -> 4}, {10 -> 9, 9 -> 8}, {16 -> 15, 15 -> 14},
  {12 -> 11, 11 -> 10}, {21 -> 20, 20 -> 19}, {13 -> 12, 12 -> 11} } }
```

```
In[*]:= AN[1] = 0;
epd /. {X_{i,j} => (AN[i + 1] := AN[i] + 1; AN[j + 1] := AN[j] - 1),
  X_{j,i} => (AN[i + 1] := AN[i] - 1; AN[j + 1] := AN[j] + 1)};
Table[AN[i], {i, 2 n + 1}]
```

```
Out[*]= {0, 1, 2, 1, 2, 1, 0, 1, 2, 1, 2, 1, 0, 1, 2, 1, 2, 1, 0, 1, 0}
```

```
In[*]:= epd /. (x : X | X)_{i,j} => X_{AN@i, AN@j}
```

```
Out[*]= EPD[X_{1,0}, X_{1,0}, X_{1,2}, X_{1,2}, X_{1,2}, X_{1,2}, X_{1,2}, X_{1,2}, X_{0,1}, X_{0,1}]
```