

Virtual Skein Theory Heavens

1. Contraction algebras

$\sqcup, C_{3x},$ comp. conditions.

Remaining ops. Linearity.

2. Example: tangles.

3. comments: Rebrw $|X|=|X|$

"circuit algebras" (~~functor language~~)

Heavens is a place on Earth

1. A 2. R

3. Implementation.

4. MVA (—)

5. A long list of skein rels.

But Heavens' too big.

1. Virtual pure tangles

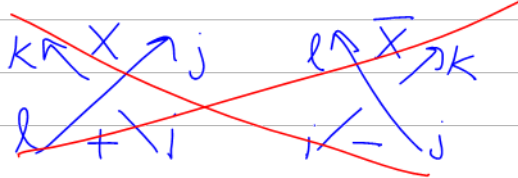
2. Γ -calculus

3. Implementation & examples.

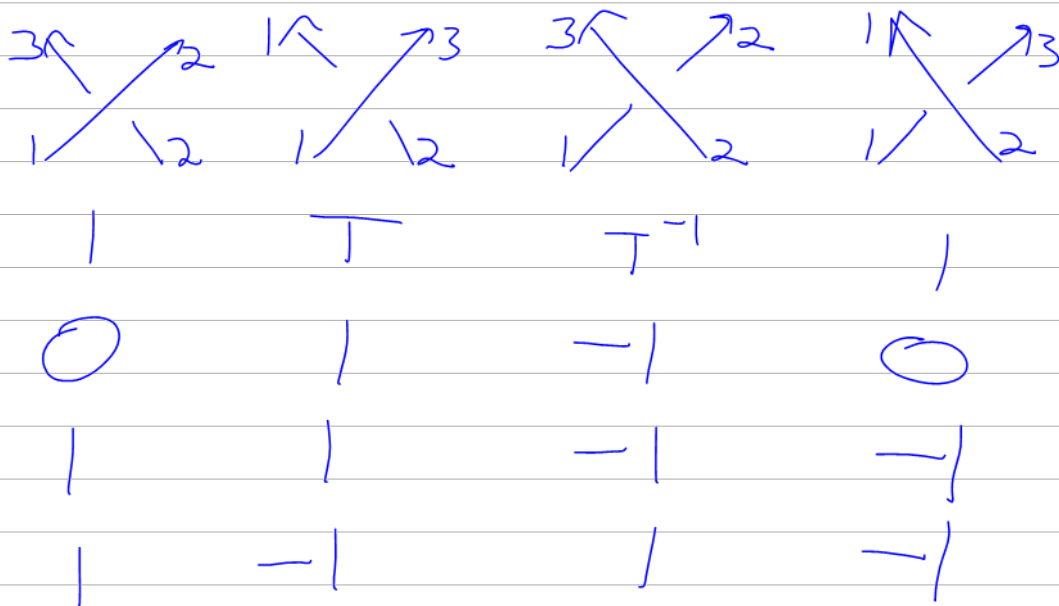
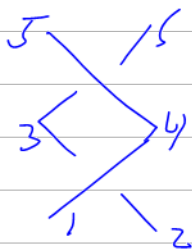
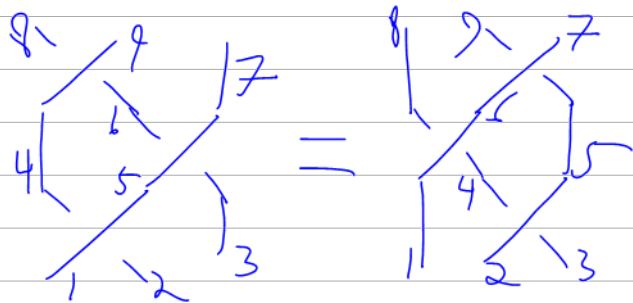
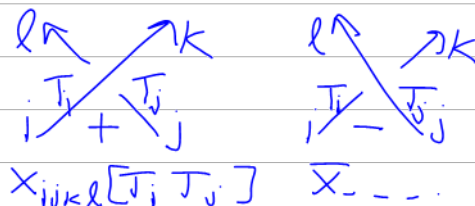
4. Habacher's Theorem.

5. tr & I don't understand.

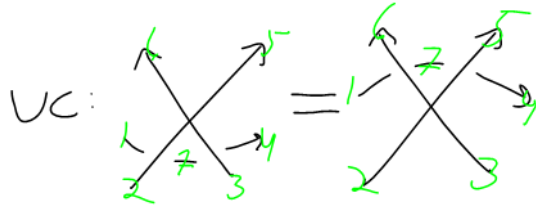
Old (KnotTheory) conventions:



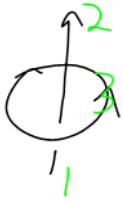
New conventions:



Relations on Classical Knots and Links.		
<p>The Skein Relation Our proof p. 67</p>		<p>Also known as Conway's relation; holds only for strands with the same label [Ale28, Con70].</p>
<p>Conway's Second Identities Our proof p. 64</p>		<p>In the single variable version these are a consequence of the skein relation[Con70].</p>
<p>Our proof p. 67</p>		
<p>Conway's Third Identity Our proof p. 71</p>		<p>This was Conways third identity in the definition of the Conway potential function [Con70].</p>
<p>J. Murakami's Fifth Axiom Our proof p. 68</p>		<p>This is J. Murakami's fifth axiom for the Conway potential function [Mur93].</p>
<p>J. Murakami's Third Axiom Our proof p. 68</p>		<p>Where $t_i = \sqrt{x_i}$. This is J. Murakami's third axiom for the Conway potential function [Mur93].</p>
<p>Naik-Stanford Doubled Delta Move Our proof p. 69</p>		<p>Parallel strands must have the same label. If two knots(links) have the same MVA then they differ by finitely many of these moves[NS03].</p>
<p>Connect Sum Our proof p. 46</p>	<p>$\Delta(K_1 \# K_2) = \Delta(K_1)\Delta(K_2)$</p>	<p>The single variable Alexander polynomial is multiplicative under the connect sum operation, there are coefficients in the multi-variable version [Ale28].</p>



Relations on Virtual Knots and Links.		
Welded Knots Our proof p. 70		The MVA is a welded knot invariant.
Our proof p. 70		These two relations are virtual versions of Conway's two second identities.
Our proof p. 71		A virtual versions of Conway's third identity.
Our proof p. 71		Versions of J. Murakami's Fifth Axiom for virtual knots.
Virtual N-S Doubled Deltas Our proof p. 71		Parallel strands must have the same label. Two versions of the N-S doubled delta move for virtual knots.



$$Q = Q' + \eta x + \xi y + \alpha \xi x$$

$$\mathbb{E}_{\xi} \mathbb{E}_x e^{Q' + \eta x + \xi y + (\alpha-1)\xi x} = \mathbb{E}_{\xi} (\eta + (1-\alpha)\xi) e^{-}$$

$$= e^{-((1-\alpha) + (-\eta + (\alpha-1)\xi))(y + (\alpha-1)x)}$$

$$= e^{- (1-\alpha) (1 - \frac{\eta y}{1-\alpha} - \xi y + \eta x + (1-\alpha)\xi x)}$$

$$\mathbb{E}_{x, \xi} e^Q = e^{Q'} - \alpha e^Q + \eta y e^Q$$

$$= ((1-\alpha) + \eta y) e^{Q'} = e$$

