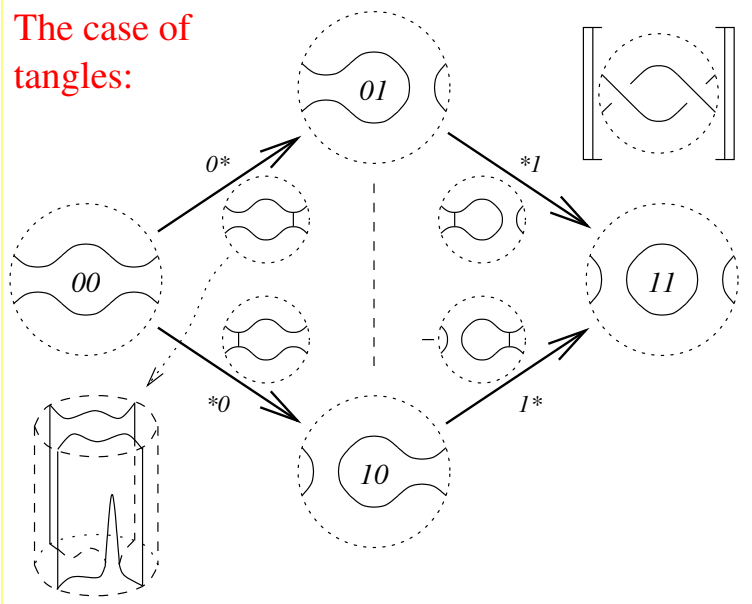




Overview of Khovanov Homology (2)

The case of tangles:



Kh(T(7,6)).

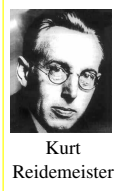
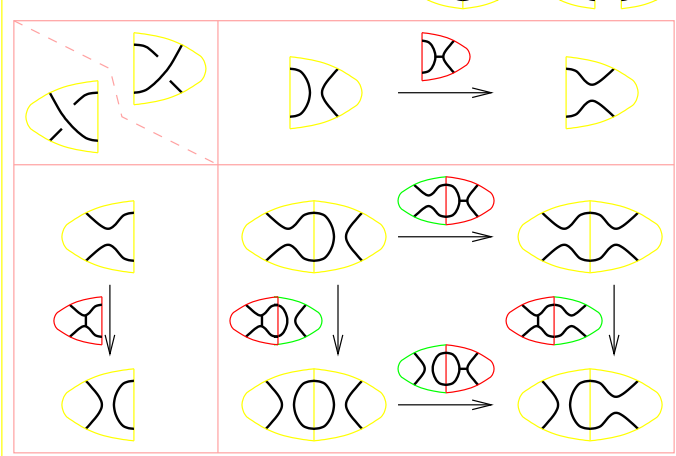
In 1 day  says  $\dim_j H_r$ is given by:

Old techniques:
~1,000 years,
~1Ggb RAM.

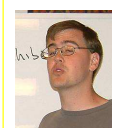
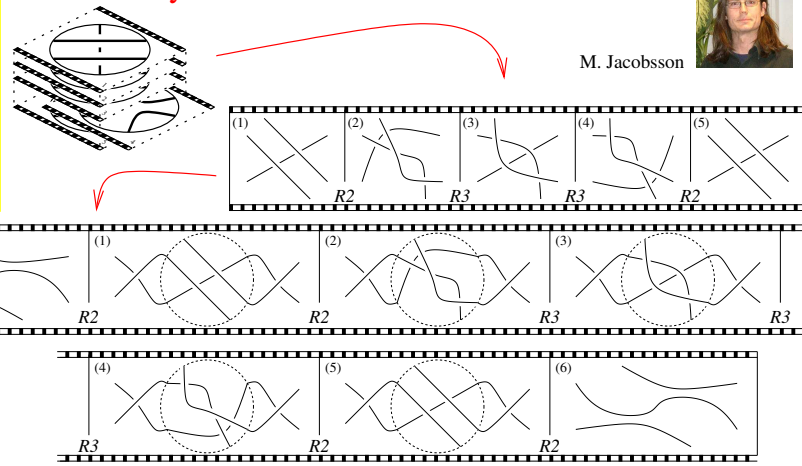
$j \setminus r$	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
57																				1	1
55																				1	1
53																1	2		1	1	
51															1	1		2	1		
49															3	1		1			
47															3	1		1			
45															2	1		2			
43															1	1		2			
41															1	1		2			
39															1	1		1			
37															1	1		1			
35															1	1		1			
33															1	1		1			
31															1	1		1			
29															1	1		1			

the alternating knots zone

Invariance under R2.



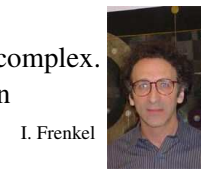
Functoriality / cobordisms.



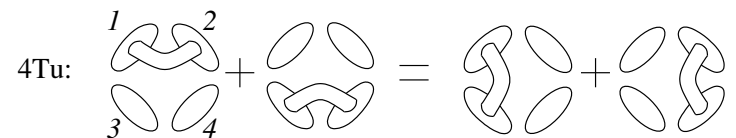
J. Rasmussen: This leads to a no-analysis proof of Milnor's conjecture

Conjecture: (I. Frenkel, though he may disown this version)

1. Every object in mathematics is the Euler characteristic of a complex.
2. Every operation in mathematics lifts to an operation between complexes.
3. Every identity in mathematics remains true up to homotopy.

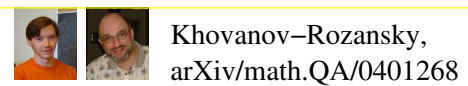


A more general theory: Remove G and NC, add



(minor further revisions are necessary)

Local differentials:



$$d \left(\begin{array}{|c|c|} \hline & \\ \hline & \\ \hline \end{array} \right) = \pm \begin{array}{|c|c|} \hline d & \\ \hline & \\ \hline \end{array} \pm \begin{array}{|c|c|} \hline & d \\ \hline & \\ \hline \end{array} \pm \begin{array}{|c|c|} \hline & \\ \hline & d \\ \hline & \\ \hline \end{array} \pm \begin{array}{|c|c|} \hline & \\ \hline & \\ \hline d & \\ \hline \end{array}$$

$$d^2 \left(\begin{array}{|c|c|} \hline \text{circle} & \text{circle} \\ \hline \end{array} \right) = 0 \text{ or } d^2 \left(\begin{array}{|c|c|} \hline \text{circle} & \text{circle} \\ \hline \end{array} \right) = \pm \begin{array}{|c|c|} \hline \text{circle} & \text{circle} \\ \hline \end{array} \pm \begin{array}{|c|c|} \hline \text{circle} & \text{circle} \\ \hline \end{array} \pm \begin{array}{|c|c|} \hline \text{circle} & \text{circle} \\ \hline \end{array} \pm \begin{array}{|c|c|} \hline \text{circle} & \text{circle} \\ \hline \end{array}$$

Matrix factorizations:

$$D = \begin{pmatrix} 0 & A \\ B & 0 \end{pmatrix} \quad \begin{array}{ccc} M^0 & \xrightarrow{A} & M^1 & \xrightarrow{B} & M^0 \\ U^0 \downarrow V^0 & \swarrow h^1 & U^1 \downarrow V^1 & \swarrow h^0 & U^0 \downarrow V^0 \\ N^0 & \xrightarrow{A'} & N^1 & \xrightarrow{B'} & N^0 \end{array}$$

$AB = BA = \omega I$

"God created the knots, all else in topology is the work of mortals"
Leopold Kronecker (modified)



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A category, with "complexes", morphisms, homotopies, direct sums and tensor products.

