GeoDict
The Digital Material Laboratory

Explain Length of Lay

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General conditions for applying Length of Lay

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- The length of lay gives the distance that is needed for the thread to perform a full 360° rotation around itself (twist).
- The structure in WeaveGeo is always generated periodically.
  - This means a thread leaving on one side of a unit cell re-enters it on the other side.
  - This holds also for a structure composed of multiple unit cells
- In general, the size of a unit cell must be a multiple of the length of lay.
  - This ensures that the thread makes an integer number of 360° rotations.
- Depending on the thread type, this condition can be weakened.
  - As a special case we show this for the 1x19 rope.

Special case: 1x19 rope

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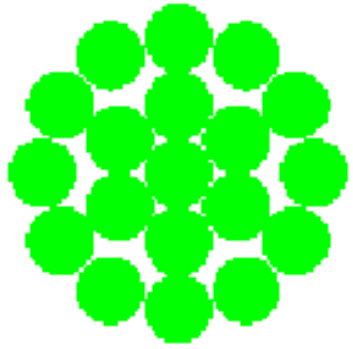
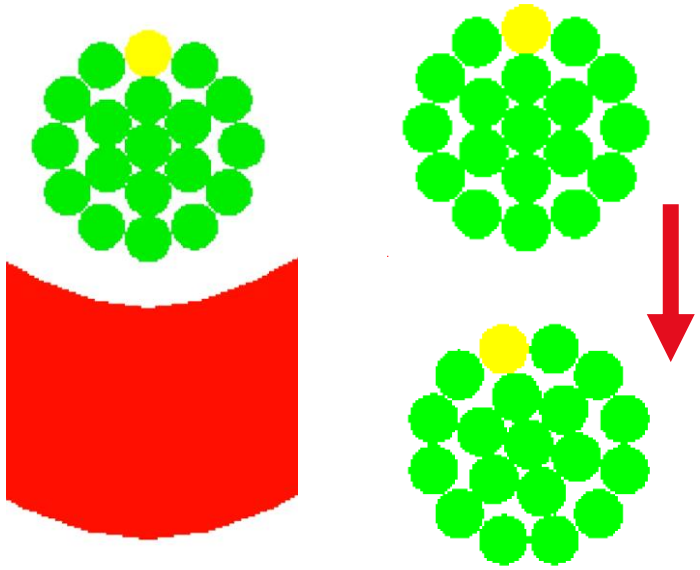
- The 19 filaments are arranged in a circular packing.
  - The outer circle contains 12 filaments.
  - The middle circle contains 6 filaments.
  - The last filament is in the center.
- For the outer circle after a rotation of 360°/12=30° every thread is on the position of another thread (see pictures on the right).
- For the middle circle this is the case after a rotation of 360°/6=60°.
- The minimal possible rotation for this kind of thread is the least common multiple of 30° and 60° which is 60°.
- The maximum length of lay (distance needed for a full rotation) is $6 * l_u$, where l_u is the length of the unit cell.



Arrangement of the filaments in a 1x19 rope



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Special case: 1x19 rope

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- In WeaveGeo, the factor how much of the rotation can be performed in the unit cell is determined by rounding $y = \frac{6 * l_u}{length\ of\ lay}$ to the next integer z.
  - This gives the number of 60° rotations.
- For the maximal length of lay we get $y = 1$.
- Smaller values for length of lay are possible.
  - In fact, the algorithm changes the length of lay, such that it fits to the computed integer value.
  - This ensures that the periodicity is maintained.
- The corrected length of lay is computed with the formula: $\text{corrected length of lay} = \frac{1}{(\frac{z}{6 * l_u})}$.

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Special case: 1x19 rope

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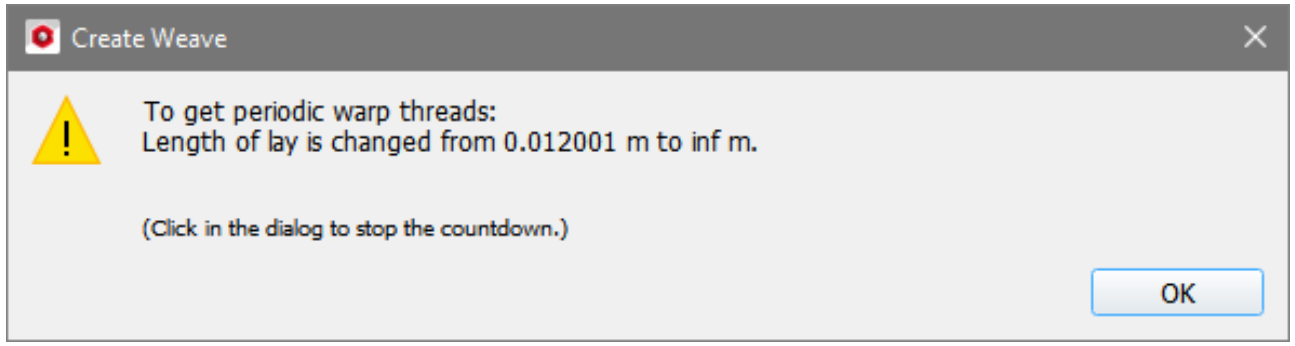
- If the entered length of lay is more than two times the maximal length of lay we get $y < \frac{6*l_u}{2*6*l_u} = 0.5$. This is rounded down to $z = 0$.
  - This means no twist is performed.
- For the corrected length of lay we get: $\frac{1}{(\frac{0}{6*l_u})} = \frac{1}{0} = inf$.
- This leads to the warning shown below.
  - We will improve this message.



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