# Documentation

## ChainLinkSource

### Applying forces for Pulling In and Pushing Out the Chain

The pushOutForce should be applied in the forward direction of the source as the winch that is in theory pushing out the chain would push it in the forward direction. When pulling in the chain, the force should be applied towards the source as the hole where the chain came out would pull the chain towards it.

The force should be applied at the beginning point of the rope.

### Aligning a ChainLink with the Source

In theory, the first ChainLink should always be aligned with the source. This means that the alignment axis always passes through the source, where the alignment axis is a vector passing through the two connection points of the ChainLink.

After the chain is shortened, then the first ChainLink should always be aligned with the source. When lengthening the chain, you lengthen the current ChainLink to fill in the gap, but don’t rotate it. If there is still more chain to create, then make new ChainLinks and rotate these towards the source.

### Determining if the Source is Behind or in Front of a ChainLink

The source lies behind the chainLink if the source lies on the negative side of a plane defined by the normal vector positionToLinkChainLinkTo -> positionToLinkToHook and the plane point positionToLinkChainLinkTo. Otherwise, the source lies in front of the chainLink.

### Determining if the Chain should be Lengthened or Shortened

The chain should be lengthened if one of the following holds:

* There is no previouslySpawnedChainLink AND the hookToConnectChainLinkTo has some distance to the source AND the maximumPushOutSpeed is greater than 0.
* There is a previouslySpawnedChainLink AND the source lies behind it AND the maximumPushOutSpeed is greater than 0.

The chain should be shortened if one of the following holds:

* There is a previouslySpawnedChainLink AND the source lies in front of it AND the maximumPullInSpeed is greater than 0.

### Lengthening the Chain

When the chain should be lengthened, it should be lengthened as much as possible under the following requirements:

* The chain is not lengthened more than would be possible with the current maximumPushOutSpeed and the time that passed.
* If there is a previouslySpawnedChainLink then the chain is not lengthened more than is needed to connect the positionToLinkToHook with the source in a straight line.
* If there is no previouslySpawnedChainLink then the chain is not lengthened more than the distance to the hookToConnectChainLinkTo.

If lengthening the previouslySpawnedChainLink is not enough to lengthen the rope to the necessary amount, then a new ChainLink is spawned.

### Shortening the Chain

When the chain is shortened, it should be shortened as much as possible under the following requirements:

* The chain is not shortened more than would be possible with the current maximumPullInSpeed and the time that passed.
* The chain is not shortened more than is needed to

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