A principle for ideal torus knots

Using bent-helix embeddings, we investigate simple and knotted torus windings that are made of tubes of finite thickness. Knots which have the shortest rope length are often denoted as ideal structures. Conventionally, the ideal structures are found by rope shortening routines. It is shown that alternatively they can be directly determined as maximally twisted structures. In many cases these structures are also structures with zero strain-twist coupling, i.e. structures that neither rotate one or the other way under strain. We use this principle to implement rapid numerical calculations of the ideal structures and subsequently quantify them by their aspect ratio. The results are compared with the aspect ratios of biological torus molecules.

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