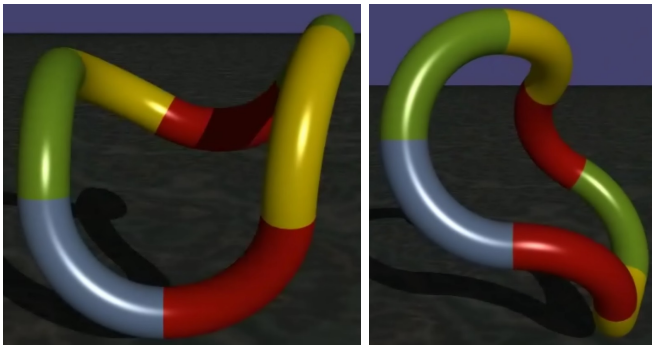

Regular seven-membered loops with arbitrary join angle in $\mathbb{R}^3$

Barry J Cox
University of Adelaide

The problem of ring molecules come up in a number of contexts in physical chemistry. Perhaps the simplest example of a seven-membered ring is cycloheptane C_7H_{14}, which is a molecule where the carbon-carbon bonds form a regular seven-membered loop. However it is possible to envisage more complicated arrangements of proteins chains comprising straight rigid sections linked in a way that enforces the same angles at all of the joins. This work is also applicable in the field of robotics where such loops are termed Bricard linkages.

In this talk we present a coordinate system that reduces the problem to four free variables and three constraints. We then survey the solutions numerically and find that there are families of solutions for all join angles θ between $\pi/7$ and $5\pi/7$ with fixed planar solutions existing for $\theta = \pi/7$, $3\pi/7$ and $5\pi/7$. The available families of solutions undergo an unexpected major reorganization at the join angle $\theta = \pi/3$. The nature of the solutions available at $\theta = \pi/3$ and their relation to the families of solution available for other angles will be discussed.