COURSE:

Applied Knot Theory (9 h)

Time: 10:00 to 13:30 (with a 30' break)

Date: 29th, 30th and 31st of May, 2019

Venue: Room C18. School of Engineering. University of Cadiz

By: Dr. Eleni Panagiotou. University of Tennessee at Chattanooga

This course is limited to 15 students. No previous knowledge of knot theory needed.

Mathematical knots are simple closed curves in space and can be classified using topological invariants. In the last decades, more and more knots are found in physical systems with important implications. For example, knots in proteins are related to disease, and entanglement in polymer melts determines their viscoelastic properties with many industrial applications. Physical knots usually do not satisfy the strict mathematical definitions of knottedness, giving rise to a new area of study, Applied Knot Theory. In order to apply mathematical tools in physical systems like polymers, computer simulations are necessary. In this course, we will overview the different definitions of entanglement arising from theory and applications and how these can be applied in practice to measure entanglement in polymers.

Day 1: Introduction to knot theory

In this class we will see some fundamental definitions and tools used to study knots.

Topics include: knots, links, crossing number, linking number, Kauffman bracket polynomial, Jones polynomial, tangles, knotoids

Day 2: Applications of knot theory

In this class we will see methods to apply tools from knot theory to problems in biology and chemistry.

Topics include: DNA supercoiling, DNA recombination, random polygons and random walks, polymer melts and solutions

Day 3: Molecular Simulation

In this class we will see some models of polymers and techniques to simulate them. We will also discuss the notion of polymer entanglement.

Topics include: Molecular Dynamics Simulations, Field Theoretic Simulations and Monte Carlo Sampling

After the course, Prof. Panagiotou will interview candidates interested in a funded research stay at the UTC.