Twining Plants : How Thick Should their Supports Be?

Sébastien Neukirch
Laboratoire de Modélisation en Mécanique (CNRS-UMR 7607)
Université Pierre et Marie Curie, 4, place Jussieu, Paris, France.

Alain Goriely
Department of Mathematics and Program in Applied Mathematics,
University of Arizona, Tucson, Arizona 85721, USA

One of the most fascinating aspects of growth in plants is found in the movements and habits of climbing plants. Climbing plants are not self-supporting and they use their surrounding environment to achieve vertical growth, e.g. tendril-bearers use modified leaves (the tendrils) to pull themselves upward, this leads to the well-known perversion of tendrils.

In this talk, I will discuss and model another strategy to achieve vertical growth: the twining of vines. Twiners grow in a helical manner around poles. In his essay "The Movements and Habits of Climbing Plants" (first published in the Journal of the Linnean Society, 1865) Charles Darwin writes: "Most twining plants are adapted to ascend supports of moderate though of different thicknesses. Our English twiners, as far as I have seen, never twine round trees...". This leads to the question : how thick a support can a (given) twining plant ascend ?

I will address this question by considering the stem of the plant as an elastic growing rod and look for stable equilibrium solutions of such a rod around a rigid cylinder.