From $3D$ nonlinear elasticity to $1D$ linear/quasilinear elastic models for thin-walled beams

Geometrically, a thin-walled beam is a slender structural element whose length is much larger than the diameter of the cross section which, on its hand, is larger than the thickness of the thin wall. This kind of beams have been used for a long time in civil and mechanical engineering and, most of all, in flight vehicle structures because of their high ratio between maximum strength and weight. From a mathematical point of view, these beams present two scaling factors: one is the ratio between the diameter of the cross-section and the length of the beam, the other is the ratio between the wall thickness and the diameter of the cross-section.

In this talk, starting from three-dimensional nonlinear elasticity we shall deduce one dimensional linear/quasilinear models for these kind of beams by means of an asymptotic analysis in which the two scaling factors go to zero. By changing the "speed" of the scale factors and the scaling of the energy we shall deduce different models.

The talk is based on an ongoing work with M. G. Mora and R. Paroni.