Thesis title:

Model reduction techniques for simulating long narrow self-deployable structures.

Abstract:

Folding of slender elastic structures incorporates extensive deformations especially, the folding associates localized flattening of the cross-section that reduces the moment of inertia abruptly and concentrates the bending deformation. Tape springs such as carpenter tapes can be used conveniently in understanding the mechanics of such structures in an experimental level. However, modelling of tape springs can be approached mainly as 1D (beam element) or 2D (shell element). Utilizing only shell elements in the model will lead to a massive number of degrees of freedom to be handled which is advantages in achieving accurate results particularly at the locations with severe deformations but at the cost of high computational effort. While in contrast, having a model only with low order elements such as beam elements will result in a simplified model which are more suitable in modelling the flattened and undeformed states. Hence, discretization of the finite element model should be carried out with the aim of tackling the trade-off between computational effort and the order of elements to be used in capturing different states of deformation.