



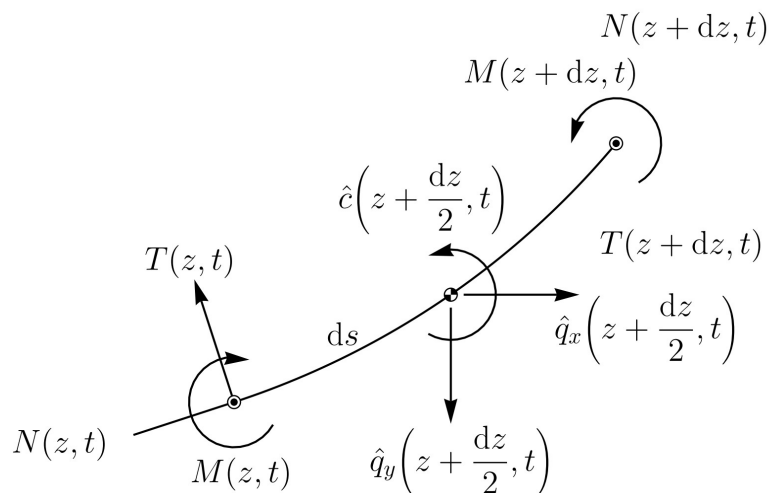
On the variational derivation of beam equations

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This work is aimed to highlight under which circumstances the equations of motion of a planar beam, obtained by the Newtonian method (i.e. “sum of forces”) can also be obtained by means of a variational (or Lagrangian) approach. The beam is considered as a 1D structural element, with arbitrary initial configuration. Exact kinematic and balance equations are used, and the condition for the existence of the Lagrangian is sought on the constitutive law.



It is found that using different measures of the curvature as a flexural strain leads to different results. In particular, the mechanical curvature leads to a variational approach under mild assumptions, while the geometrical curvature (which from many points of view is the most natural) does not.