

A Nonlinear Simple Wave Solution for Elastic Wires

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Communicated by ERNST BECKER

Dedicated to Professor Dr. Karl Klotter on the occasion of his 70th birthday.

1. Introduction. Strings and wires are examples of slender structures for which one-dimensional models are appropriate, if the ratio of a typical diameter over a characteristic length is sufficiently small. In a simple model, the wire is replaced by a flexible center line (the line connecting the centers of gravity of the cross sections), and the cross sections are assumed to move like rigid discs fixed on the center line (see fig. 1). This model, a one-dimensional Cosserat

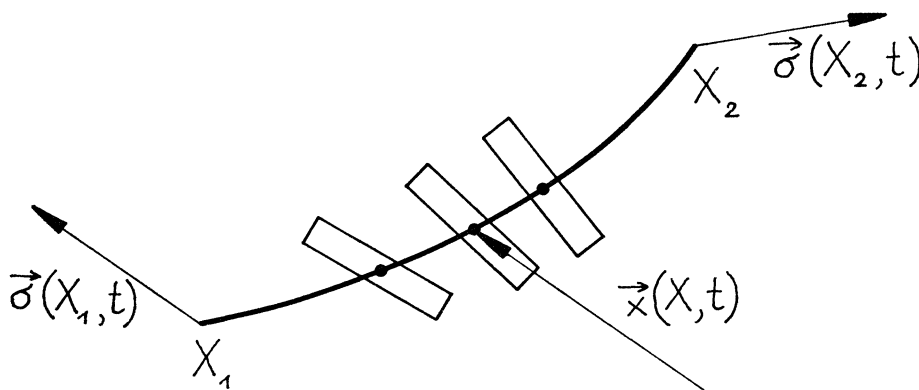


FIGURE 1: One-dimensional wire model

continuum, is essentially a generalization towards large deflections of the Timoshenko beam model of technical beam bending theory. It is adequate to describe three kinds of deformations of an actual wire: extension by the stretching, and bending by the curvature of the center line, shearing by the rotation of the cross sections relative to the center line. Lateral contraction associated with extension, and warping of the cross sections are not included. Thin wires