J Elast (2015) 119:1–2
DOI 10.1007/s10659-015-9516-7

Foreword

Special Invited Collection on the Mechanics of Ribbons and Möbius Bands

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This volume of the Journal of Elasticity contains a collection of papers dedicated to the historical development of and current research interests in the mechanics of the Möbius band. It contains four translations of landmark papers, originally written in German, that played a major role in the development of this and related topics in mechanics: three published by Sadowsky from the 1930's and one published by Wunderlich in 1962. In addition, there are twelve current research papers and reviews that provide insight into the intricate mechanics of stretchable and unstretchable elastic bands, their preferred equilibrium shapes as well as the geometry of surfaces and the representation of isometric mappings. A Möbius band need not be a ruled surface, but it may be a developable surface, which is a kind of ruled surface, with the additional property that it may be continuously flattened into a planar form while preserving its intrinsic lengths and angles, i.e., the result of an isometric mapping of a flat domain into a surface. The papers in this collection address mathematical and computational issues covering this wide range of possibilities.

The Möbius band was formally identified as an object of mathematical interest in the mid-nineteenth century. The first publications to include discussions of its topological properties were those of Listing in 1862 and Möbius in 1865. It has, though, been reported that both Listing and Möbius recognized the importance of the Möbius band a little earlier in 1858 and that in his 1847 study of topology Listing even made passing remarks concerning twisted ribbon-like surfaces.

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The influence of the Möbius band now extends well beyond mathematics to encompass multiple branches of science and engineering, architecture, philosophy, psychology, and the musical, visual, literary, and performing arts. New directions for exploiting its intriguing topological properties in science and engineering have emerged in response to recent breakthroughs in the ability to fabricate objects with molecular-scale precision. Novel ideas of inductionless resistors and superconductors with high transition temperature, molecular engines, and helical magnetism have been proposed. It is the intriguing one-sided, one-edged, nonorientable nature of Möbius bands that is driving much of the modern work toward discoveries and applications of nanotechnological importance.

This volume is intended to enhance growth in, and provide insight for, the advancement of fundamental research and discovery in mechanics related to ribbons and the Möbius band. The contributions are wide in scope and they illustrate the important role that mathematical modeling and computation play in this novel area of research.