Textile materials differ in numerous aspects from conventional engineering materials. They are inhomogeneous, highly anisotropic and deformable, and can suffer large deformations and displacements within a plane at low stress under ordinary conditions and/or during normal use. Knowing their behaviour under low stress is the basis for the engineering planning of fabrics, product development, computer-aided design, and the numerical modelling and simulation of clothing and other products for technical applications. This monograph is aimed at providing a critical appreciation of scientific understanding in those areas related to complex deformations of textile structures. These contents are subdivided into two thematically-connected parts. Part I addresses the basic issues regarding the complex deformations of a textile structure and the simulation of drape performances, whilst Part II places emphasis on the 3D modelling of the human body, and clothing simulation. This monograph that builds practical, professional and academic foundations for tomorrow's engineers will be an essential reference for academics, professionals, students, researchers, and designers within industry.

J. Geršak

The monography was written by Jelka Geršak, Univ.-Professor for Clothing Engineering at University of Maribor, Marianna Halász and Péter Tamás, Assoc. Professors at Faculty of Mechanical Engineering of Budapest University of Technology and Economics and Livia Kokas Palicska, Assoc. Professor at Institute of Product Design of Obuda University.

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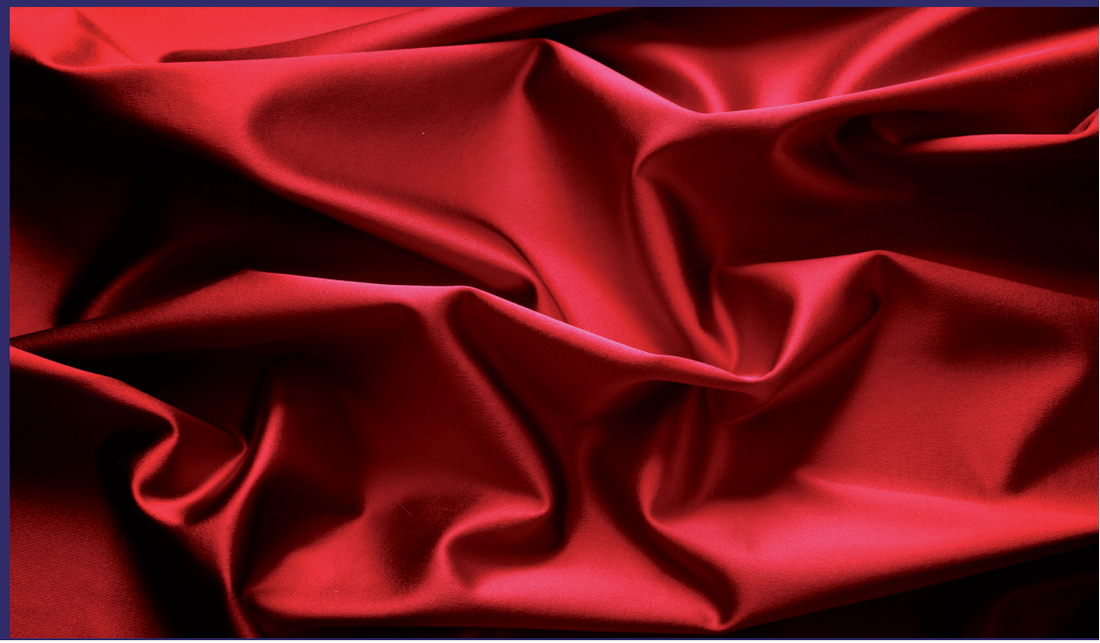

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Complex fabric deformations and clothing modelling in 3D

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COMPLEX FABRIC DEFORMATIONS AND CLOTHING MODELLING IN 3D

COMPLEX FABRIC DEFORMATIONS AND CLOTHING MODELLING IN 3D

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PREFACE

Textile materials differ in numerous aspects from conventional engineering materials. They are inhomogeneous, discontinuous, highly anisotropic, and deformable. They can suffer large deformations and displacements within a plane at low stress under ordinary conditions and/or during normal use.

In view of the specific behaviour of textile materials and growing requirements regarding the engineering planning of textile materials' quality parameters, investigations into textile structures' complex deformations and the relationships amongst the non-linear mechanical properties and material behaviour at low stresses gain in importance. Understanding and knowing about the non-linear mechanical properties of textile fabrics and their behaviour under low stress has become a starting-point for the engineering planning of fabrics and products made from them, quality control, product development, process and product optimisation and, last but not least, for computer-aided design, construction, and the numerical modelling and simulation of garments and other products for technical applications.

The following seven chapters provide an overview of complex fabric deformations and the 3D modelling of clothing. These contents that summarise the 10 year inter-university research work of four researchers from three Universities, i.e. University of Maribor (SI), Budapest University of Technology and Economics (HU) and Óbuda University (HU), are subdivided into two thematically-connected parts. Part I addresses the basic issues in the complex deformations of a textile structure. The first chapter provides a study of the complex deformations of a textile structure in view of the two- and three dimensional drape and outline of draping as an aesthetic performance of

clothing appearance. The measuring and simulation of drape performance and fabric drape behaviour as the functions of some influential parameters are given in the two following chapters. The asymmetrical behaviour of complex textile structures is described in the fourth chapter.

Part II places emphasis on the 3D modelling of the human body and clothing simulation. Chapter five gives an overview of the reg-trade development, resp. of those techniques used by computer-aided design systems in view of the spatial design, modelling, and virtual garment fitting. Chapter six reports on the measuring and modelling of the human body, where the Sylvie 3D system is used in modelling. Chapter seven reports on 3D clothing design using the Sylvie system and application of the Sylvie 3D system throughout the clothing industry.

The monograph is intended for a wide spectrum of readers, including students, researchers and academics, as well as professionals in the field of clothing design, engineering and other aspects of modelling and virtual garment fitting.

I would like to take this opportunity to thank all co-authors for their valuable time devoted to writing the chapters for this monograph.

Jelka Geršak

Part I

COMPLEX DEFORMATIONS OF TEXTILE STRUCTURE