TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

The wrinkling of thin membrane-like connective tissue structures

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motion optimization for the selected cycling tasks (steady-state cycling with constant velocity, climbing with constant velocity on the slope, starting the motion i.e. gaining the speed as fast as possible).

The user-oriented computer programme was developed in order to perform various simulation cases. As results the optimum kinematics and dynamics of cycling motion were calculated and some practical proposals concerning computer-aided cycling simulator were formulated.

I. BIOMECHANICS OF SOFT TISSUE

A CONSTITUTIVE EQUATION FOR THE MEDIAL COLLATERAL LIGAMENT OF RABBIT KNEE JOINT

WANG YI-JING and WENG SHENG-LONG (Shanghai University of Science and Technology, China)

The generalization form $G(t, \varepsilon)$ of the uniformizing relaxation function $G(t)$ which was proposed by Fung was used to investigate the viscoelastic properties of the rabbit medial collateral ligament. The reduced relaxation function was obtained on various levels. The elastic response and the reduced relaxation function obtained from the experiment takes the forms as follow

$$\sigma^e(\varepsilon) = 241.211\varepsilon + 44580.7\,\varepsilon^2,$$

$$G(t, \varepsilon) = (0.903693 + 0.439383\,\varepsilon) - (0.0313137 + 0.0344139\,\varepsilon)\log t$$

The investigation showed that the uniformizing reduced relaxation function depended on the strain level as well as the relaxation history. It was a linear function of the natural logarithm of relaxation time under constant strain level. By using the generalization uniformizing relaxation function $G(t, \varepsilon)$, Fung's theory can be used to describe the viscoelastic characteristics of ligament quite well. The study showed that the capacities of the ligament sustaining the stress level were different on different strain levels.

A MICROSTRUCTURE STUDY OF NORMAL AND SCOLIOTIC SPINAL LIGAMENTS

L. H. YAHIA, G. DROUIN and C. H. RIVARD (Centre de Recherche Pédiatrique, Hôpital Ste-Justine, Montréal, Canada)

The purpose of this study is to investigate the structural properties of normal and scoliotic human spinal ligaments. Supraspinous, interspinous and yellow ligaments obtained from normal and scoliotic subjects were examined by light and scanning electron microscopy. Comparison between the normal and scoliotic yellow ligaments indicates only slight differences. However, alterations in the morphological factors such as collagen waviness and its arrangement are observed in the supraspinous ligaments and to a lesser extent in the interspinous ligaments. The more pronounced remodelling occuring in the scoliotic supraspinous ligaments may be related to their anatomical location having farthest distance from the flexion–rotation axis.

THE WRINKLING OF THIN MEMBRANE-LIKE CONNECTIVE TISSUE STRUCTURES

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The objective of our research is to study the force transmission from muscle to bone near the elbow joint by thin membrane-like connective tissue structures. Because of their geometry these membranes will wrinkle easily. In geometrically linear analysis wrinkling of isotropic and anisotropic membranes has been studied. In geometrically non-linear theory only isotropic membranes have been studied.

Since the connective tissues may show large deformations, non-linear stress–strain curves and anisotropy a new model has been developed capable of dealing with these phenomena.

The Finite Element Method is used to solve the field equations numerically. A membrane element which is able to wrinkle has been developed. The numerical model has been tested on a case of simple shear.

THE EFFECT OF METAL IMPLANTS ON TENDONS AND SOFT TISSUES

M. A. MASEM, J. EULENBERGER, E. SCHNEIDER, B. RAHN and S. M. PERREN (M. E. M.-Institute for Biomechanics, University of Bern, 3008 Bern, Switzerland)

In hand surgery, internal fixation is suspected to induce pathological changes responsible for postoperative stiffness. Therefore, a biomechanical, histological and surface ultra-structural study of the changes in tendons and ligaments adjacent to metal plates was undertaken.