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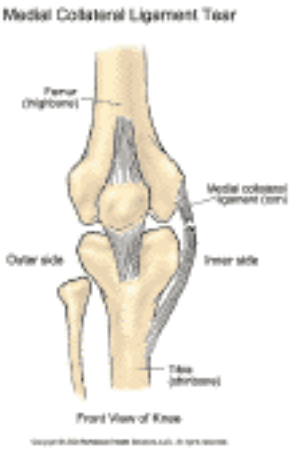
ELE 482
"Nonlinear Ligament Viscoelasticity"

Abstract- Ligaments display time-dependent behavior characteristic of a viscoelastic solid. Viscoelastic solids are have historically been modelled using a Quasi-Linear Viscoelasticity formulation. A recent study conducted by the University of Wisconsin, has negated this formulation under certain circumstances .

Ligaments are fibrous bands or sheets of connective tissue linking two or more bones, cartilages, or structures together. These tissues provide stability to a joint during rest and movement. All ligaments have been lumped into a pool of acceptable human tissues for a Quasi-Linear Viscoelasticity formulation to predict stress-strain responses.

A study conducted by the University of Wisconsin tested their hypothesis that this formulation was flawed in many ways and that the stress-strain predictions only allowed for certain conditions and left others unanswered. This study utilized the Medial Collateral Ligaments from eighteen (18) euthanized Sprague-Dawley rats. They uses these MCL's for three different responses.



The first part of the study was concerned with relaxation tests after a strain. The second part concerned creep, or a comprehensive load test. The third part utilized both tests. The purpose was to achieve results and then plug results into a log-log plot and prove that the non-linear results could not be mapped by a simple exponential.

The results proved their hypothesis correct and showed that at the low ends and high ends of the strain tests approach asymptotic values. This study calls for a more general formulation that takes into account load history and the nonlinearities in rates that effect strain.

References:

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