

## An introduction to Quantitative Assessment of Stiffness and Shock Absorption (Viscoelastic Characteristics) of the Musculoskeletal System using Mass-Spring-Damper Models in the Field of Physiotherapy

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### Abstract

Viscoelasticity (stiffness and shock absorption) is the main behavior of all body tissues and therefore the whole musculoskeletal system. Changes in the stiffness and shock absorption ability of the musculoskeletal system can affect the movement biomechanics, performance, and finally the risk of injury. According to the importance of the viscoelastic properties of the body, measurement of these properties after applying various physiotherapy interventions can lead to a better understanding and more accurate usage of therapeutic methods.

Mass-spring-damper (MSD) models have been proposed in the late 80s, however, their usage in the field of physiotherapy is still limited. Most previous literature has studied the local viscoelastic behavior or using a simple mass-spring model. As one of the main goals of physiotherapy is to examine the whole body behavior in performance, studying global viscoelastic behavior of the musculoskeletal system can bring new insights about human performance. With MSD models and data obtained from the motion analysis system, force plate, or accelerometer, the stiffness and shock absorption of the whole musculoskeletal system can be calculated.

With the use of the MSD model, we calculated the viscoelastic behavior of the body after applying kinesio tapes. We found the great shock absorption effect of kinesio tape.

Consequently, the therapeutic effects of one of the popular physiotherapy interventions can be explained with the use of an interdisciplinary approach and calculating methods. Therefore, we can take steps to bring the physiotherapy interventions to the evidence-based therapeutic methods to achieve a common language among the medical community using a scientific perspective.

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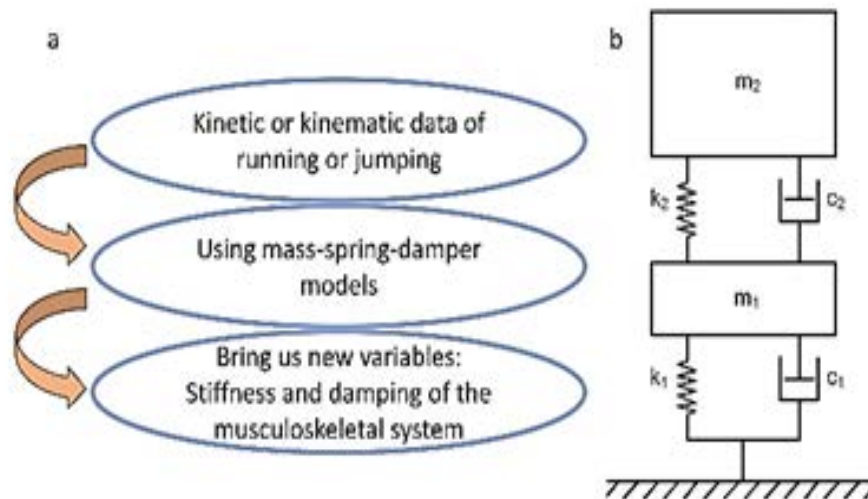


Figure 1: (a) The process of obtaining the viscoelastic variables (stiffness and damping) of the musculoskeletal system. (b) A two degree-of-freedom mass-spring-damper model.

## Recent Publications

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