Book Proposal on Biomimetic Tissue Simulants

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Abstract

Soft tissue surrogate based test dummies are used across industries to simulate real life accidents. To date, there are a wide range of surrogates available in the market, including gels, elastomers, and animal tissues, which are backdated and have mechanical properties very different from actual human tissues. However, in academic research, biofidelic soft tissue surrogates have evolved in the last two decades, but have lacked technology transfer. This book aims to bridge the gap between the industry and academia with the state of the art in soft tissue surrogate research. Surrogates are presented with respect to skin, muscles, brain tissue, arteries, and female pelvis. Fabrication techniques, mechanical testing, and test results required for reproducing these surrogates are discussed. Also, characterization methodologies and limitations of each type of surrogate are presented, for their use in both experimental and computational research. Some major industries which can use these biofidelic surrogates are car manufacturers, prosthetics and orthotics designers, ballistic testing facilities, military and sports equipment manufacturers. Also, hospitals and medical centres can take advantage of these synthetic surrogates over actual tissues for surgical training with minimal biosafety approvals and ethical issues.

1. Introduction

These references will get you started. Then search the citations within the references and the ones citing the article to make sure. Soft tissue surrogates currently used in the industry for biomechanical testing are backdated and very different from live human tissues with respect to mechanical properties. This goal of this book is to present the state of the art in development and characterization of soft tissue surrogates in academic research for their immediate translation into the industry, for both experimental and computational testing. (Arnab Chanda, Unnikrishnan, Roy, et al., 2015)(Arnab Chanda, Callaway, Clifton, et al., 2018)(Arnab Chanda & Unnikrishnan, 2019)(A. Chanda & Ghoneim, 2015)(Arnab Chanda, Graeter, et al., 2015)(Arnab Chanda et al., 2016a)(Arnab Chanda & Unnikrishnan, 2017)(Arnab Chanda, Unnikrishnan, Flynn, et al., 2017)(Gupta et al., 2020)(Arnab Chanda & Unnikrishnan, 2016)(Arnab Chanda & Callaway, 2018)(Arnab Chanda, Unnikrishnan, et al., 2018)(Arnab Chanda, Meyer, et al., 2017)(Arnab Chanda, Unnikrishnan, & Flynn, 2015)(Arnab Chanda, Ruchti, & Unnikrishnan, 2018)(Arnab Chanda, Flynn, et al., 2018)(Arnab Chanda & Unnikrishnan, 2018b)(Arnab Chanda et al., 2016b)(Ghoneim & Chanda, 2013)(Arnab Chanda, Unnikrishnan, & Lackey, 2017)(Kushner, 1992)(Arnab Chanda & Curry, 2018)(Arnab Chanda, 2017)(Arnab Chanda, 2018a)(Arnab Chanda, Jones, & Beschorner, 2018)(Arnab Chanda & Unnikrishnan, 2018c)(Arnab Chanda & Graeter, 2018)(Arnab Chanda, 2018b)(Arnab Chanda & Unnikrishnan, 2015e)(Sundaram et al., 2020)(Arnab Chanda et al., 2019)(Arnab Chanda & Unnikrishnan, 2018a)(Arnab Chanda,

Ruchti, & Upchurch, 2018)(Arnab Chanda, n.d.)(Beschoner et al., 2020)(Arnab Chanda, Chatterjee, et al., 2020)(Arnab; Chanda et al., 2019)(Arnab Chanda, Unnikrishnan, et al., 2020)(Arnab Chanda & McClain, 2019)(Arnab Chanda & Upchurch, 2018)(Arnab Chanda & Unnikrishnan, 2015b)(Arnab Chanda & Unnikrishnan, 2015d)(Arnab Chanda & Unnikrishnan, 2015c)(Arnab Chanda & Unnikrishnan, 2015a). This information would be indispensable for fabrication of biofidelic test dummies for automotive crash testing, testing of lethal and non-lethal ballistics, personal protection equipment (PPE) testing in military and contact sports. Also, prosthetic and cosmetic implant industry experts can test the surrogates for improvement in the material comfort and aesthetics of products developed in the future for end consumers. Additionally, these synthetic biomaterials can potentially replace live tissues used for surgical training in clinical settings, requiring almost no biosafety approvals. The major audience for this subject would be research experts in the automotive and sports equipment industry, prosthetics and orthotics, and in the military. Doctors and medical practitioners can also use this information for improved surgical training. Also, a growing community of academic researchers working on soft tissue biomechanics would be able to take advantage of this knowledge for replacing live tissues used in testing, and thereby reducing the cost and time associated with lab.

2. Materials and Methods

Discuss about experimental setup, material characterization steps, and hyperelastic models for curve-fitting.

3. Results and Discussion

Key experimental results from one paper for each tissue. We can discuss further on this.

4. Conclusion and Future Directions

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Declaration

We declare no conflict of interest

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