Stiffness Compensation in Hand Prostheses With Cosmetic Coverings Using Statically Balanced Mechanisms

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Although hand prostheses with a cosmetic covering are commercially available for disabled people, the operating effort due to the stiffness of the mechanism is high. This results in high power requirements. This paper aims to present a new concept of mechanisms for the compensation of the nonlinear stiffness of hand prostheses by using statically balanced mechanisms with a nonlinear behavior. This concept was based on a combination of stability phases of snap-through buckling in bistable spring mechanisms to create the nonlinear balancing force. To demonstrate the efficiency of the concept, an optimized design for a case study of a child-sized hand prosthesis is also presented. A pattern search method was applied for the optimization. As a result, the calculated stiffness and, thereby, the operating effort was reduced by 96%. It can be concluded from the conceptual and numerical results that the presented concept provides a highly efficient solution to the discussed problem.

Predictive Modeling of Transplant-Related Mortality

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This paper describes the application of machine learning approaches for predictive modeling to improve the estimation of risks for complications of allogeneic hematopoietic cell transplantation (HCT) including relapse, graft-versus-host disease, and transplant-related mortality (TRM). Clinical disease and demographic factors known to impact the outcome of HCT include: recipient and donor age, type of donor (related/unrelated), donor-recipient gender, diagnosis and disease status pre-HCT, and stem cell source (peripheral blood, marrow, and umbilical cord blood). However, biostatistical analysis of risk has only limited accuracy in estimating a given patient's risks of serous post-HCT complications. We describe the application of standard support vector machine (SVM) classifiers for data-analytic modeling of TRM. The goal is to predict the binary output TRM (alive or dead) from a set of genetic, demographic, and clinical inputs. Classification decision rule is estimated using SVM approach appropriate for such sparse multivariate data. This study compares several feature selection techniques for modeling TRM and objectively evaluates the quality of feature selection via prediction accuracy of the corresponding SVM classifiers. In addition, we discuss methods for interpretation of multivariate SVM models.