# Electrical Safety Issues of Dielectric Elastomer Actuators for A Force Feedback Glove

#### Keywords

Electrical safety, dielectric elastomer, actuators, high voltage, force feedback, glove

#### Introduction

In a virtual environment a haptic feedback glove enables the human user to touch and manipulate the virtual object by providing a haptic feedback to the user. It is now a challenge for traditional actuation technologies to meet the requirements on a compact, portable and light-weight force feedback glove that exerts enough forces on the human hand.

Electroactive polymers (abbr. EAP, also called "Artificial Muscles") have emerged in the last decade as a promising actuation technology in the field of muscle/insect-like actuators, robotics etc. The novel characters such as light-weight, high energy density, and high flexibility show great potential for a portable and wearable haptic feedback glove. A dielectric elastomer (a subgroup of EAPs) actuator, outputting a linear motion, has been demonstrated at EMPA. However, the extreme high driving voltage in a range of 5-10 kV limits EAP applications for devices to be worn on the body. To solve this problem one way is to insulate the actuators and provide adequate electrical safety to the human operator.



# Task description

The goal of the semester work is to find a suitable insulation materials and to construct an electrical circuit that prevents the user from short shut. Firstly the insulations issues on the EAP-based force feedback glove will be studies. Next in the literature research one should clarify the electrical safety criteria to human beings and EU/USA directives on device electrical safety. In the third step, a suitable insulation material should be found out and, in the fourth/fifth step, their mechanical/electrical properties will be experimentally determined. Parallel to the study on insulation materials, an electrical circuit will be design and constructed. As for a semester work, presentations and final thesis are required at the end.

# Time/ work place

Summer semester 2005, ETL / ETH Zentrum

# Focus of the task

- · Analysis of electrical safety issues for EAP-based force feedback gloves
- Literature research: EU and USA Directives on electrical safety of medical devices; Directive on electrical safety to human beings
- Set up of electrical safety criterion for the FFD device
- · Experimental determination of electrical properties of cylindric dielectric elastomer actuators
- Definition of requirements on electrical insulation materials
- Searching for suitable electrical insulation materials
- · Experimental characterization of the insulation materials-mechanical properties (static and dynamic)
- · Experimental determination of electrical properties of the selected materials
- · Design and construction of an electrical circuit that prevent short-cut.
- Intermediate and final presentation
- Written semester thesis

# Informationen & Administration

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