Morphing the SmartMesh: Proposing a Novel Control Architecture

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Abstract. In this paper we propose a novel control algorithm for the SmartMesh [1] based on clothes simulation modelled with masses and springs. The SmartMesh is modelled as a tissue or as a blanket, which is attracted by the object that has to be represented, enveloping it. Applying the sampled data (the lengths of the springs) to the actuators of the SmartMesh will result in a deformation of the structure. The SmartMesh is a deformable mechanical structure and has recently been proposed as a novel type of haptic display affording the output of 3D shapes with the purpose to give a wide area haptic feedback.

1 Introduction

The rising number of human computer interfaces incorporating haptic feedback capabilities, such as some of the commercially available mice or similar devices and more advanced haptic feedback devices, such as the Phantom [4], the CyberGrasp [6] or the the Haptic Master [5] for instance, reflect the growing need for more intuitive and powerful interfaces. Simultaneously to that growing need, the requirements on quality and working space have been evolving. Wide area haptic feedback for instance, is mandatory for many applications, such as the simulation of palpation, or such as the simulation of objects and prototypes in the first phases of the product development.

After many studies and basic research we believe that one way to successfully realize such a wide area feedback device is the development of so-called smart structures (according to Spillman's group, a smart structure is "a non-biological physical structure that has: (1) a definite purpose, (2) means and imperative to achieve that purpose, (3) a biological pattern of functioning." [7]), capable of simulating the objects themselves or at least the sections of interest. The SmartMesh is a first attempt to develop an active deformable structure offering output and input capabilities.

2 The SmartMesh

The SmartMesh [2], a double-layered grid of nodes linked by prismatic joints, can be deformed by simply altering the lengths of its linkages. The second layer