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Integration of smart textile functions into 3D textile structures combinations and examples with future prospect

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1. Introduction

Three-dimensional (3D) textiles at first hand promise a reduction of manufacturing costs and an increase of material quality for many applications. Because on one hand, 3D textiles offer reduced no. of parts and consequently reduced assembling costs and on the other hand 3D textiles offer increased structural integrity like uncut reinforcing threads or seamless fabric surfaces (Buesgen, 2006). Moreover, the theoretical potential and possible advantage of this type of textile can be much higher if functional elements (e.g. light signals, sensoric spots, heating or cooling elements) can be integrated into 3D textiles. This paper investigates the combination possibilities for smart and 3D textiles taking into account the recent state of manufacturing and design methods for 3D textiles on one hand and smart textile technology on the other hand.

2. Types of 3D textiles, manufacture and application

Textiles in combination with the term 3D has been used and is understood in many different ways. A more or less common agreement seems to be the diversification between "through-the-thickness" and "near-net-shape" textiles.

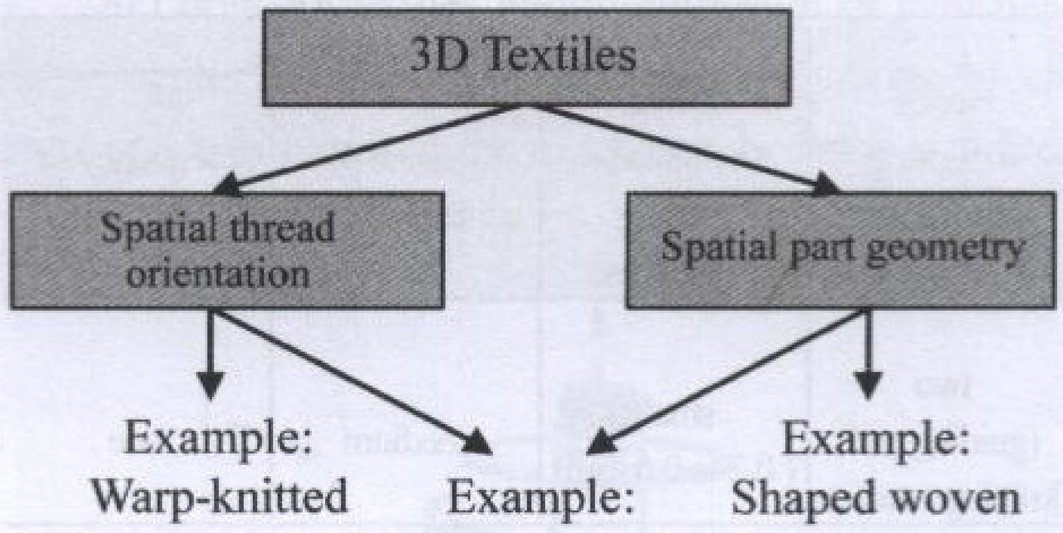

Fig. 1. Classification of 3D Textiles and selection of examples

Three different types of 3D Textiles have been selected for this paper (Figure 1):

a) warp knitted spacer fabrics as an example for textiles with spatial thread orientation ,

b) Shaped woven fabrics as an example for textiles with spatial part geometry and

c) 3D Braids as an example for textiles with spatial thread orientation and spatial part geometry.

2. 1. Spacer fabrics

Spacer fabrics are commonly manufactured by

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