Aspects of Modelling Skin and Hair During Shaving

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A preliminary model of shaving has been constructed using the ABAQUS/Explicit solver. It consists of a single hair mounted in a block of bi-layered skin, across which a razor traverses. Modelling features include (1) deformable and non-deformable contact boundary conditions between the razor, skin and hair, (2) material moduli ranging over seven orders of magnitude and (3) infinite elements to simulate far-field boundary conditions. The skin material properties are described using a large strain, viscoelastic material model, based on experimental test data. Current work is focussing on the modelling of hair cutting. The purpose of this paper is to highlight the problems associated with developing a physiological model and the hurdles faced in simulating hair cutting with the ABAQUS/Explicit solver.

1. INTRODUCTION

On average, a man spends 139 days of his life shaving his beard hair; a daily ritual that is repeated almost across the entire globe. In the North Atlantic market alone, consumers spend over \$2 billion a year on shaving products, making shaving a huge multinational concern. The study of beard hair removal has developed over the last 100 years into a complex biological science that increasingly utilises sophisticated modelling techniques, such as finite element analysis.