

SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)
Poster Session (P)

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HUMAN SKIN STRAIN FIELD OF THE ELBOW JOINT FOR MECHANICAL COUNTER
PRESSURE SPACE SUIT DEVELOPMENT

Abstract

This paper presents high-resolution human skin strain field data around the elbow joint measured using digital image correlation (DIC) in order to develop mechanical counter pressure space suits. Developing skin-tight space suits requires detailed understanding of human skin deformation at the body joints in order to create mechanical counter pressure without restricting human mobility. In the past, skin strain mapping has been performed using infrared motion capture systems that are limited to spatial resolution near 4 cm². Utilizing 3D DIC, an optical computer vision technique often used in solid mechanics and material testing to measure surface strain, we measure spatial resolution less than 1 cm². Measuring in vivo skin deformation around body joints is challenging because of large deformations and complex surface geometry that limits the line of sight from the cameras. Skin is also difficult to speckle pattern. In order to overcome these challenges, methods for speckling techniques and camera placement have been developed specifically for human skin strain mapping. Results and techniques for skin strain mapping around the elbow joint using digital image correlation are presented and discussed in the context of realizing a mechanical counter pressure space suit for planetary exploration.