A DEXTEROUS SOFT GRIPPER FOR HANDLING SOFT FABRIC BRA CUPS

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MEng/PG Diploma in Manufacturing Systems Engineering

Department of Mechanical Engineering

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Thesis/Dissertation submitted in partial fulfilment of the requirements for the degree
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DECLARATION

I declare that this is my own work, and this Dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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The supervisors should certify the Dissertation with the following declaration.

The above candidate has carried out research for the MEng in Manufacturing Systems Engineering Dissertation under our supervision. We confirm that the declaration made above by the student is true and correct.

Name of Supervisor: Dr. J. R. Gamage

Signature of the Supervisor: Date: 22/05/2024

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ABSTRACT

The handling of sensitive and soft fabrics is a challenge in the textile industry. Typical mechanical gripping methods are incapable of handling soft fabrics without causing damage. In the context of automated sewing operations, the need for a gripping system that mimics human hands is crucial to the successful implementation. A potential solution for this is the use of soft compliant grippers. The apparel industry has yet to incorporate soft grippers into intimate apparel production, where automation is becoming increasingly necessary to handle delicate fabrics and bra cups. The sensitivity of these materials to mechanical contact and stresses has necessitated the development of innovative solutions. This study presents a novel approach to gripping breathable soft bra cups, using a pneumatically actuated three-chamber soft bending actuator with three independently controllable degrees of freedom. The three sections allow for independent actuation on a monolithic structure 3D printed from TPU. This design enables a gripper that can adapt its shape to the complex contours of a bra cup. Experiments evaluating the actuator's flexural ability and blocking force showed a maximum bending angle of 34°, a vertical travel of 53mm, and a blocking force of 1.7 N at the tip at 0.7 MPa. The gripper developed using the proposed actuator was able to successfully grip and lift soft fabric bra cups without causing any damage to the fabric during the experimental evaluation under laboratory conditions.

Keywords: Gripper, 3D Printing, Compliance

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