Software for Customized Development of Partial Hand Prostheses in the 3D-Printed Prosthetics Community

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This work developed an accessible software for the development of 3D-printed prostheses for people with partial hand loss. Partial hand loss is the most prevalent form of amputation among upper limb amputations. Community efforts have created affordable 3D-printed prosthetic hands for upper-limb amputees. However, these hands are not easily customized without CAD experience, and given the variety of partial hand loss, they are often not well-suited for the user. This project provided streamlined software for the semi-automatic generation of a prosthetic hand optimized for an individual and focused on accessibility and adaptability. After manipulating a pseudo skeleton of joints and "painting" a scan of a residual limb to define the socket, the user would simply export the software's generated files for 3D-printing. To create variable flexibility and breathability in the sockets, a pattern of holes was generated across the mesh. The first phase of testing proved the socket's ability to retain a proper fit on the residual limb with minimal displacement under loads nearing 100N. The second phase of testing involved a qualitative assessment that validated the prostheses' robustness, ease of manufacturing, and kinematics. The software required low computational-cost with generation times varying from a matter of seconds to a maximum of 15 minutes. Ultimately, the developed program provided a comprehensive solution to easily create optimized prostheses for those with partial hand loss.

Awards Won:
Third Award of $1,000
Association for Computing Machinery: Fourth Award of $500
International Council on Systems Engineering - INCOSE: Certificate of Honorable Mention, a 1-year free student membership to the INCOSE, and free virtual admission to the 2022 International Symposium of the INCOSE