Invention Title: Modular Task-Specific Prosthesis

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Problem Solved by the Invention: Generalized body-powered prostheses are effective at gross movements (such as full-hand grasping), but are not robust in the performance of more morphologically or technically challenging tasks. For this reason, existing prostheses are generally not intended for specific activities. Additionally, those existing devices which are activity-specific can't be easily adapted to other specific tasks.

How the Proposed Invention Solves the Problem: The proposed apparatus allows for the use of a standardized prosthesis for a wide range of activities, far beyond the capabilities of existing body-powered prostheses, through the implementation of modular end-effectors, optimized for use in varied situations. These modular end-effectors are simple to replace, lightweight, and inexpensive; this allows for customization of the prosthetic device's capabilities to match the demands of the user and the activity. End effectors are mounted to a universal mating geometry located at the simulated wrist joint, and can introduce varied mechanisms for end effector control and manipulation (i.e. passive spring resistance, dashpots, tensioning cables, clamps, fasteners, etc.) in tasks requiring significantly different movement patterns and force production.

Unique Aspects of the Proposed Invention: Existing prostheses tend to be bulky, expensive, and tailored to a single task or generalized to common grip patterns. Prosthetic devices which are generalized to common grip patterns (i.e. cylindrical grasp and palmar pinch) work well for gross manual tasks and basic object manipulation, but fail in the performance of tasks requiring sophisticated movements or modified kinematics. Alternative, task-specific devices can be used in these more complex and difficult movements, but often need to be completely donned/doffed by the user due to a lack of universally modular end effectors. The proposed apparatus is unique from both of these options in that it is lightweight, low-cost and can be fitted with a large variety of compatible end effectors for various tasks.

How the Proposed Invention Improves on Existing Solutions: This invention improves on pre-existing designs by simplifying the use of task-specific prosthetic devices, and creating a large set of end effectors which can be implemented quickly and simply, without the need of donning/doffing the prosthesis.

Which Elements are Necessary? Optional? All elements are necessary for the modular prosthesis and shown task-specific end effector to properly function.

Relationship Between Components: Prosthetic socket [1] houses the user's residual limb, and is affixed to the arm above the elbow joint by arm gauntlet [2]. Leaf springs [3] are affixed to the modular end effector [Detail A] at the adductor/abductor link [4]. The flexor link [5] is held within the adductor/abductor link [4], and is adjustable via spring-loaded ball detents. The pronator/supinator link [6] is affixed to the flexor link [5], and employs an internal compression spring for the production of resistance to pronation and supination motions of the wrist. Tool holder [7] is attached to the pronator/supinator link [6] via elastomeric (TPU) cable, and clamps the tool (cello bow) [8] securely for performance of the task.

How Components Work Together: Once fitted to the user's residual limb via prosthetic socket [1] and arm gauntlet [2], passive control of (in this case) cello bowing position is accomplished via spring tension regulation of wrist adduction/abduction by leaf springs [3] and adductor/abductor link [4]. Wrist flexion is user-selectable with 5° - 90° adjustment angles through the use of spring-loaded ball detents in the flexor link [5] which engage with detents in the adductor/abductor link [4]. Maintenance of force of the cello bow on the instrument's strings is performed by a small compression spring located in the pronator/supinator link [6]. Secure fixturing of the tool (cello bow) [8] is accomplish through clamping the tool holder [7] to the pronator/supinator link [6] with elastomeric cable.