Development of a Hand Movement Device for Children with Cerebral Palsy

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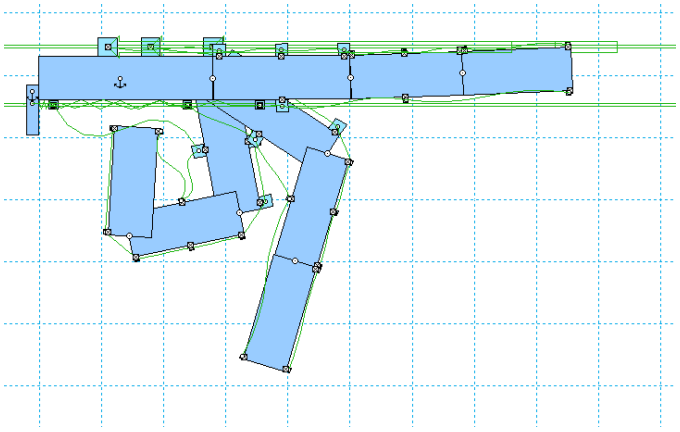
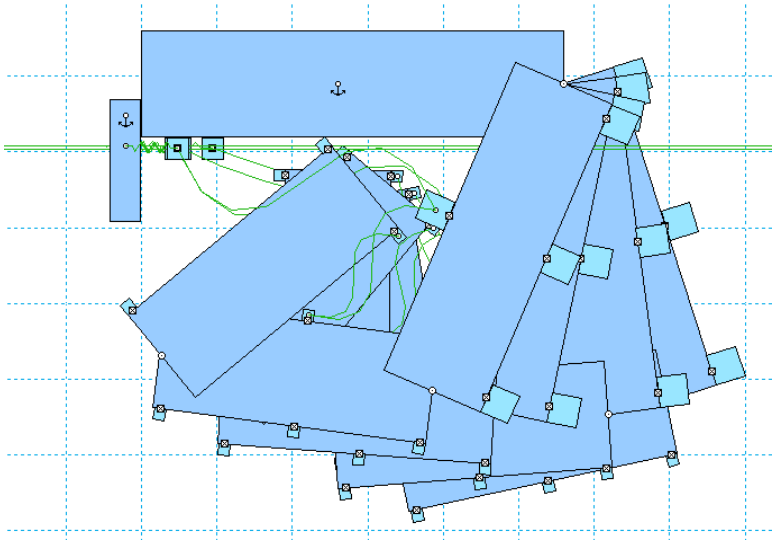
Cerebral palsy is the second most common neurological birth defect. There are over a half-million people with cerebral palsy in the United States with over 9,000 new cases each year. Cerebral palsy is a brain injury that causes disorder of muscle control. This disorder in motor control causes many other problems, which include muscle spasticity, muscle weakness, and abnormal posture of body parts. A specific example of this is the manner in which children with cerebral palsy hold their arms and hands. They often hold their arms tight to their chest, wrist flexed and fingers curled in tight. This is a result of spasticity and increased passive stiffness of flexors in the arm. The purpose of this project is to develop a small portable device that will help teach children with cerebral palsy to extend their fingers. The ultimate goal is to develop a machine to open their fingers, independent of the child's ability to apply control their fingers. As the child's muscles develop, the repetitive conditioning with the machine will develop an increased capability to extend fingers. In turn, the machine will adjust from passive movement to active-assistance and eventually to active-resistance.



Thus far, the focus of the project has been on creating a dynamic model of the finger. This model was created from kinematics data on finger opening and the rotation of each individual finger joint. The model was made in stages first starting with two segments and then moving to three. The final finger opening model is shown with intermediate screen shots. This model has the ability to apply force to ensure proper finger kinematics at all three joints. The current design is only of the index finger.



The next model is the development of a model with tight flexors, which is representative of the physical condition of children with cerebral palsy. This design just pulls in on itself until the finger is held closed very tightly. The next step is to then apply and exoskeleton to this CP model.