The Enhanced Development and Testing of the Abaxial Appendage of a Bio-mimetic Platform for Fish Mating Behavior

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Research

Title: The Enhanced Development and Testing of the Abaxial Appendage of a Bio-mimetic Platform for Fish Mating Behavior

We formulated and tested three hypotheses. Hypothesis I: The displacement of a fish replica due to simultaneous linear motion along the x and y-axis, results in the fish replica moving in a spatial probability defined as an ellipse. Hypothesis II: The vertical, z displacement of the support rod due to the linear actuator, while the rod undergoes simultaneous linear motion along a horizontal x and y-axis, results in a spatial probability defined as a parabolic cylinder. Hypothesis III: A biomimetic replica can be used to stimulate live fish and the analysis of resulting fish behavior can show differences resulting from physiological or genetic variations. The experiments to test the first two hypotheses were conducted. The components were designed in Solid Works (SW). The whole platforms, including the new appendage, were assembled in SW. Computer simulations and mathematical analyses were performed in SW. Videos of the virtual functioning of the platform and the motors constituting the structure of the platform were analyzed using the Pro-Analyst software. Manual analyses of the geometry of the models for the fish trajectories were also performed. The plastic components of the arm were fabricated by means of the Dimensional Elite industrial 3D printer. A Makerbot printer was also used. The major part of the platform was constructed with 2 cm × 2 cm aluminum t-slotted frame. A program code to operate the platform was written using the Arduino software. The platform was assembled and the motion of the appendage with the fish replica recorded as videos. By means of the ProAnalyst software, the videos will be analyzed. We were able to demonstrate that the experimental data were consistent with our hypotheses.

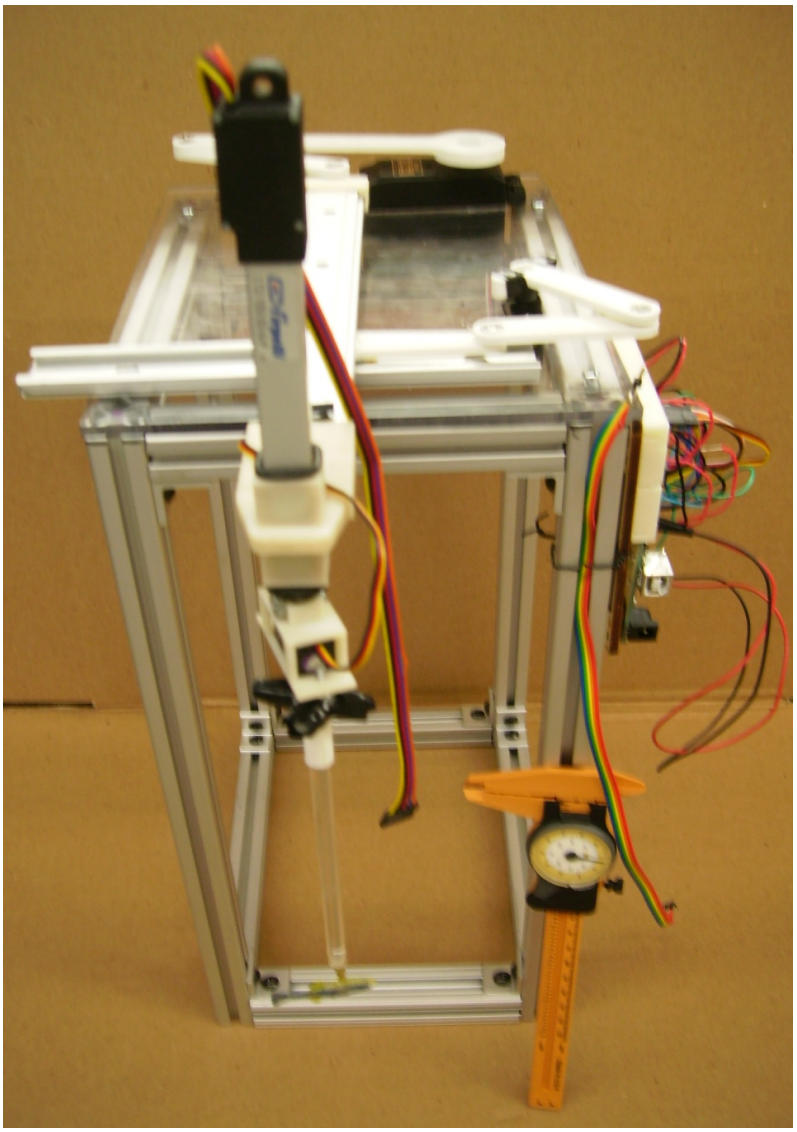


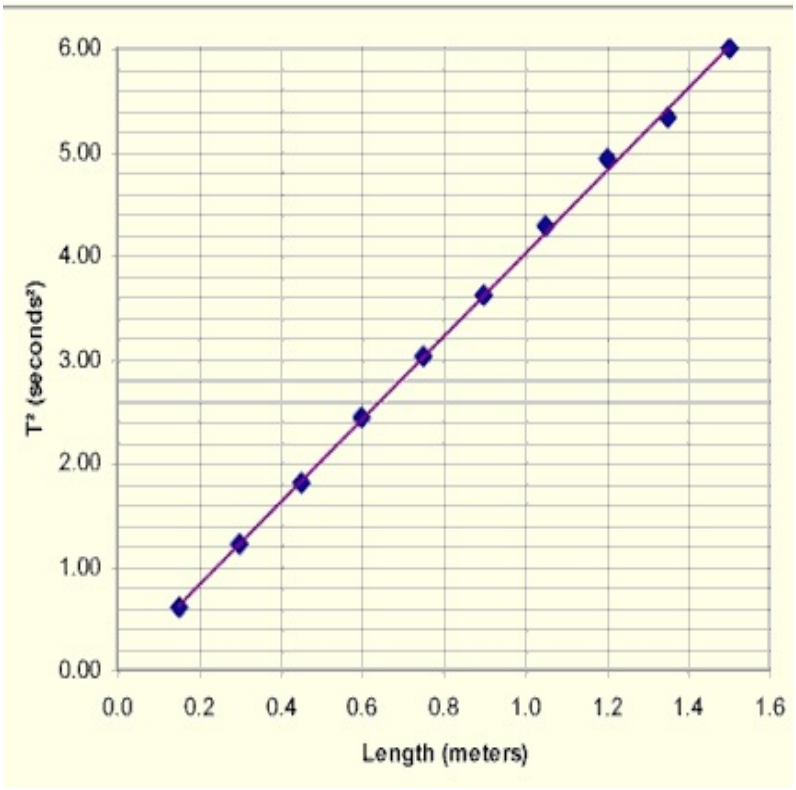
Figure 1. The Bio-mimetic platform with its appendicular appendage

Lesson Plan

Title: Restless Baby Syndrome (RBS)

Students will investigate a hypothetical syndrome called “Restless Baby Syndrome” (RBS). This syndrome will be documented on a website which consists of case studies, videos of [actor] parents whose babies suffer from the syndrome, and data collected by a [fictitious] local hospital. Teams of students will have to analyze the information presented, develop a hypothesis about the cause of the syndrome, and “invent” a solution to help families deal with the problem. Students will present their solutions and be evaluated by their peers. This project will kick off a year of design/engineering projects intended to prepare students for the Innovention competition next Spring. As students read and watch the material presented on the RBS website, they will learn that RBS causes babies to sleep poorly, cry for hours, and generally raise the stress level in households. Desperate parents try all kinds of things to “cure” the syndrome and their efforts are documented in case studies. In addition, medical records of the babies presented in the case studies are given. Mathematical analysis of this data will show

a strong correlation between a RBS patient's heartbeat, and the rate at which a parent rocks the baby to settle them down. (Research will show that rocking is the only thing that can settle a RBS baby and let them sleep.) Optimum solutions will require the ability to rock a baby with precise period/frequency related to the baby's heartbeat.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