VEX Robotics: No More Vexing in Robotics

Career Readiness Online Challenge

Zhou, PeiHong

TenTon Robotics Team 1010E

1750 Mathers Ave, West Vancouver, BC V7V 2G7, Canada

From an early age, I have been exposed to simple robots. When I was 10-11 years old, I experimented with various designs in the Lego RCS tool kit. I was amazed by the cool things it can do: a wobbly penguin, a simple harmonic pendulum, an interesting device to send morse code, etc. While these little things might appear simple in nature, they invited me to explore simple and intricate robotic designs as I grew older.

When I studied abroad in West Vancouver, I discovered Mechatronics Robotics "TenTon Robotics" as an option in West Vancouver Premier Academy. Without a second thought, I signed up for it. While I was excited to be accepted, unbeknownst to me, my experiences with TenTon Robotics would bring dramatic changes to my notions on robotics and engineering.

VEX Robotics, the name of educational robotics that etched into my mind, became the main chorus of my robotics experiences in the next few years. The knowledge I was exposed to within the first month of Robotics Academy was overwhelming: the field elements that were picked up by robot arms and gears and chains that transferred energy to the arms and robot brains that commanded the movements of the robot and sensors that retrieved and analyzed data and everything in the robot that was powered by motors.

Motors. What are different types of motors? What is the gear ratio that determines its torque and angular velocity? How to properly wire the motors to the brain? What are the dimensions and power capacities of the motors?

The questions never ended, and I was invited to the realm of mechanical engineering. VEX Robotics became my entrance to that realm, professional exposure to robots at the industrial level. With the unlimited potential to construct intricate robotics design in a confined space, VEX Robotics answered all of my questions regarding every component of a robot. To me, building VEX robots was an enjoyable process, for it enriched my knowledge of engineering and provided hands-on experience with mechanical engineering. However, as I learnt to build different

Me holding a robot with the structure of a Double-Reverse-Four-Bar

types of robot bases and structures, robotics appeared to lean more heavily on experiences, and conceptual knowledge of robotics started to dwindle. I started to design robots by trial and error: if I did not know whether something will work or not, I physically built and tested them. Undoubtedly, I gained experience at a fast pace - and I sometimes could instinctively determine the most efficient structure - but I eventually was forced to devote more time to construct the robots as I tried to implement more difficult structures. Determined to address this issue, I sought the connection between governing physics principles and applications of mechanics.

During the summer vacation of grade 10, I took advantage of a significant educational opportunity to study a university-level general engineering course, where I witnessed a professor demonstrating the application of concepts to mechanics.

"Listen." I recalled what he said: "If there is one thing you take away from this course, remember INPUT + PRODUCTION = OUTPUT + ACCUMULATION."

Initially, I scratched my head at this so-called "book-keeping statement". However, I later came to an epiphany of the application of this statement on mechanical engineering. I would shortly illustrate my point in a scenario where a motor tried to rotate an axle:

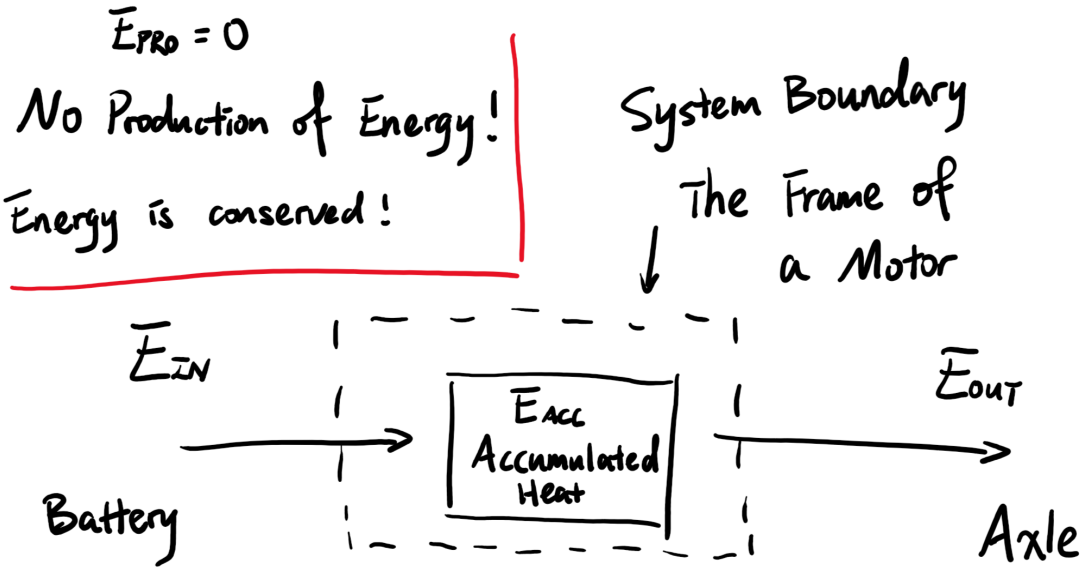
First, I needed to determine the value being described (or, as the professionals call it, the "currency" of the statement). In this case, the currency is energy. Then, I will treat the motor itself as the system boundary.

INPUT: the energy provided by the battery.

PRODUCTION: energy is conserved, no production.

OUTPUT: the energy carried out by the axle connected to the motor.

ACCUMULATION: the energy that heats up the motor.



Once I dissected the elements of the function, I arrived at a clear view of the phenomenon. In this case, the output is wanted, and accumulation is unwanted. I then could propose a set of questions and solutions to improve the performance of the motor. What may happen when I overload the motor? The motor will overheat and break. How should I address this issue? Run the motors with two-minute cycles - work two minutes, rest two minutes.

Aided by technical methods, I continue to explore efficient and intricate designs and applications of mechanical engineering. As I run faster into the heart of mechanical engineering, I delve deep into the book-keeping statement and return with fruitful applications of VEX Robotics. By exploring VEX Robotics and related concepts, I am equipped with not only the skillset required for mechanical engineering but interdisciplinary critical thinking skills that bridge me from the nuances of theories to applications in actuality - a new perspective of life that unfolds my careers in the future. With years of VEX Robotics experience, along with passion and determination in mechanics, I am confident to enter the realm of mechanical engineering and careers alike.