

Internal Combustion Engine Research

Energy Science and Technology

UC Berkeley - Combustion Analysis Laboratory*

Professor Robert Dibble

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Abstract

Professor Dibble's Combustion Analysis Laboratory is working towards reducing our carbon footprint and pushing the envelope of energy efficiency conversion problems that are on the forefront of the combustion community. I was fortunate to be able to have a helping hand in these efforts this past semester. My involvement ranged from machining new parts, assembling those and other parts on the engine test cell, and supporting the PhD students perform engine experiments.

The end result of all of this semester's work is completing and firing the Cooperative Fuel Research (CFR) Engine test cell, pictured in Figure 1 below, where everything around the engine was newly designed and installed. The intended goal of this project is to analyze the advantages of an Argon Power Cycle (APC) on a small scale platform before taking it to a larger scale in energy plants. The main performance specs we are: the designed 65 percent overall efficiency, which surpasses current method's efficiency, and, the ability to reuse the argon working fluid and extract pure CO₂ - recycling the CO₂ naturally instead of releasing it into the atmosphere.

Of the components around the engine, I assembled the high and low pressure intake and fuel lines starting at the gas tank's sensor wall mount shown in Figure 2, to the secondary wall

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mount, showing in Figure 3, before connecting to the intake pipe and port injector on the CFR cylinder block, shown in Figure 4.

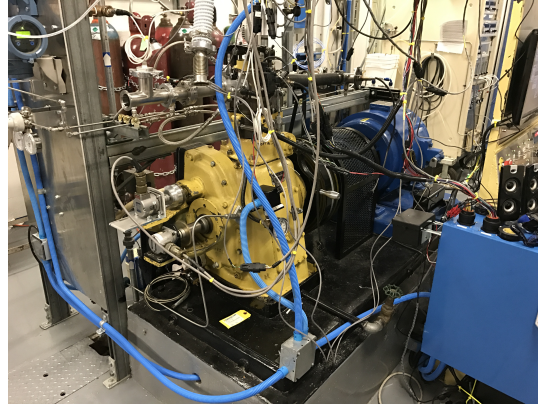


Figure 1: Completed CFR test cell in Hesse Hall.



Figure 2: Intake flow meter, pressure gauge and sensor mounting wall.

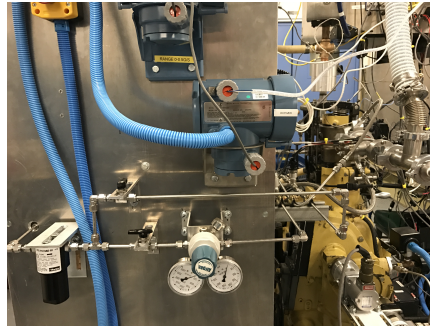


Figure 3: High-Low pressure fuel line routing secondary wall.

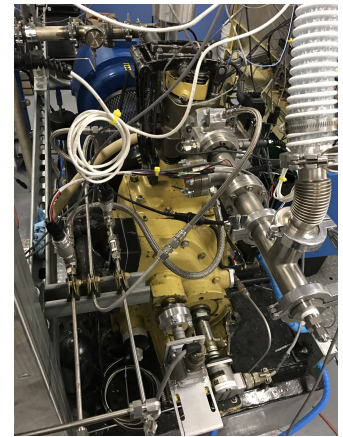


Figure 4: Intake runner with injectors, pressure transducers and thermocouples attached.

Additionally, I helped machine custom components, inserts and port injector bodies to tailor various pressure transducers, thermocouples, shaft encoders and spark plugs on the engine setup. This not only put my reverse engineering skills to a test, but also gave me a better proficiency in how these sensors worked, how they are calibrated and where to extract the critical parameters that comprise the intake and exhaust lines, combustion chamber and engine blocks.

This combustion research has complemented the theory learned in classes such as Heat Transfer and Thermodynamics. I feel rewarded knowing that this data will promote cleaner and more efficient combustion processes for commercial use, helping to solve our current energy paradigm problems. Since joining the lab, I have learned many fascinating concepts behind a variety of efficient alternatives, where the Argon Power Cycle (APC) is the most recent, and I look forward to continuing such projects in the near future.