MULTI-DOMAIN MODELING OF AN ELECTRIC AIRCRAFT

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Background

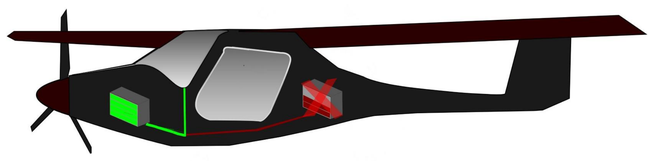
- In transportation electrification has become a driving force in the quest for sustainability which can be seen in automobiles and aircraft.
- This research aims to optimize the use of batteries in small electric aircraft with digital models simulated in MATLAB – Simulink.
- Using this model we can see the effects of varying flight plans and loads on the overall system especially the battery. With these in mind planning can be done to maximize battery health

6-seat light aircraft

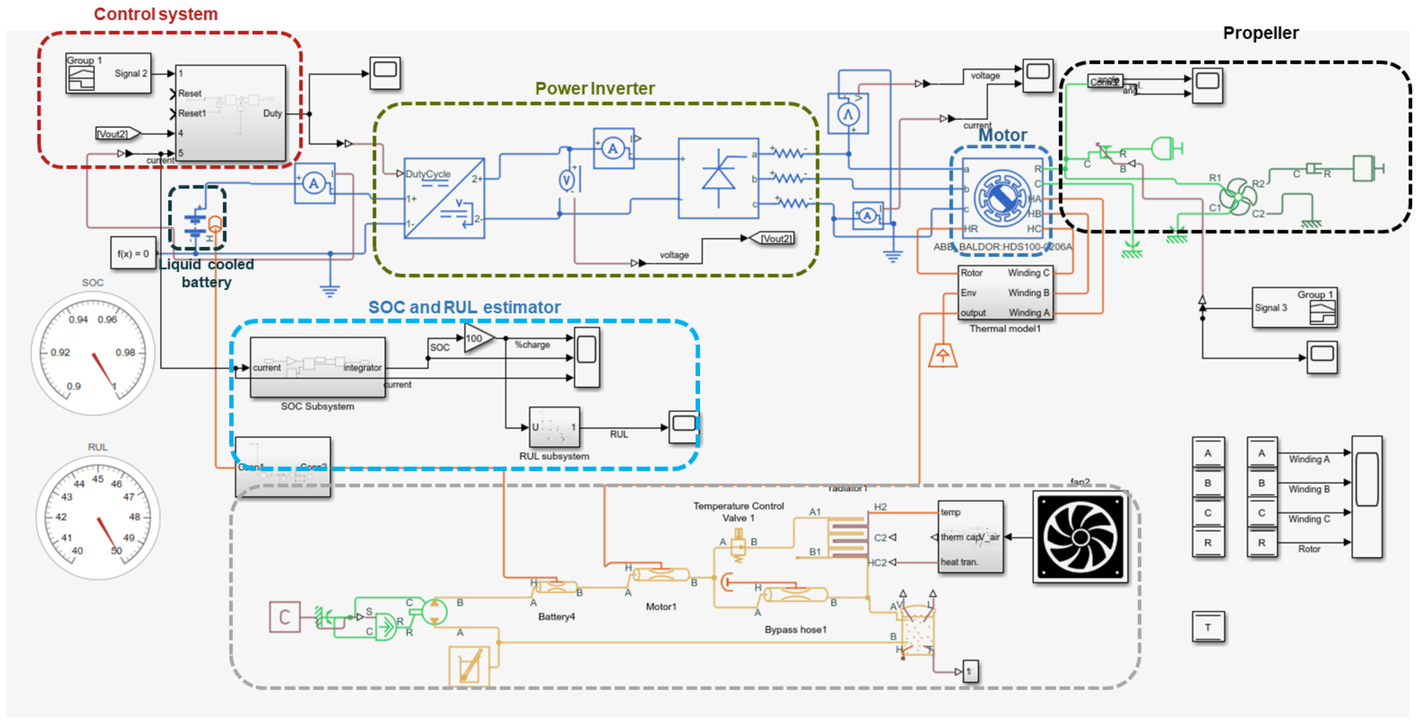
Cessna 206
https://cessnaferrypilot.com/

- 6-seater non-electric aircraft for short haul flights commonly used in regions like Alaska
- 300 horsepower (220KW)
- Max speed:174mph
- Cruise speed:163mph
- Range: about 840 miles with a 45 minute reserve
- Battery capacity would be about 110 Kilowatts-hour

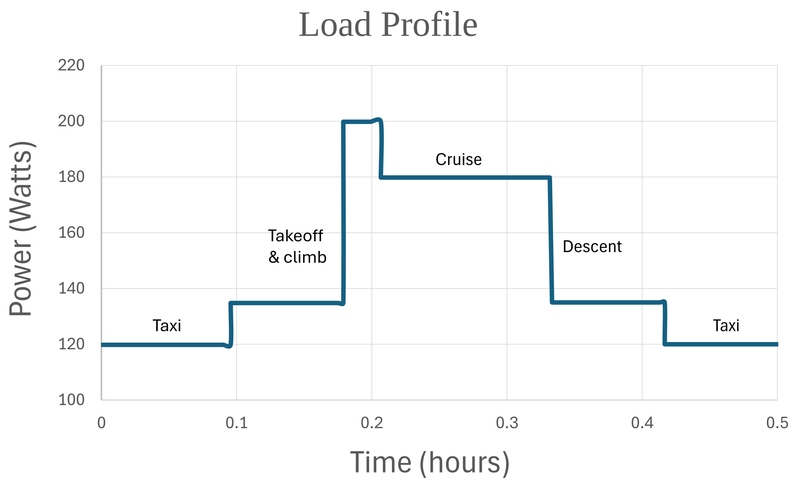
Pipistrel Velis Electro

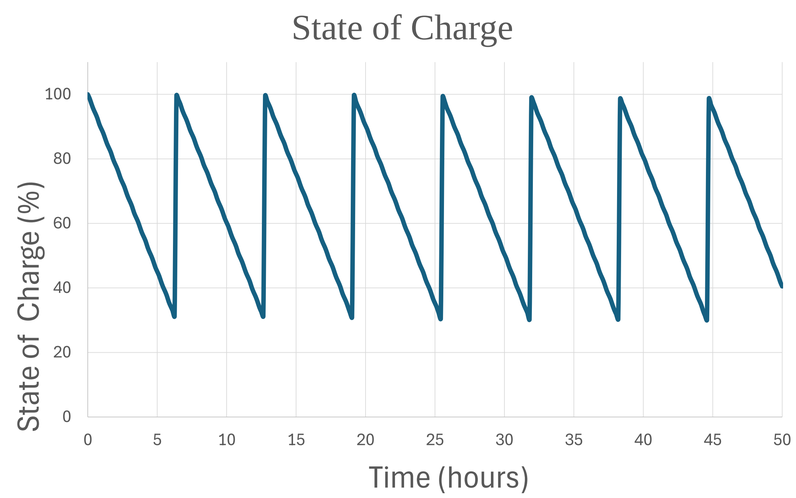


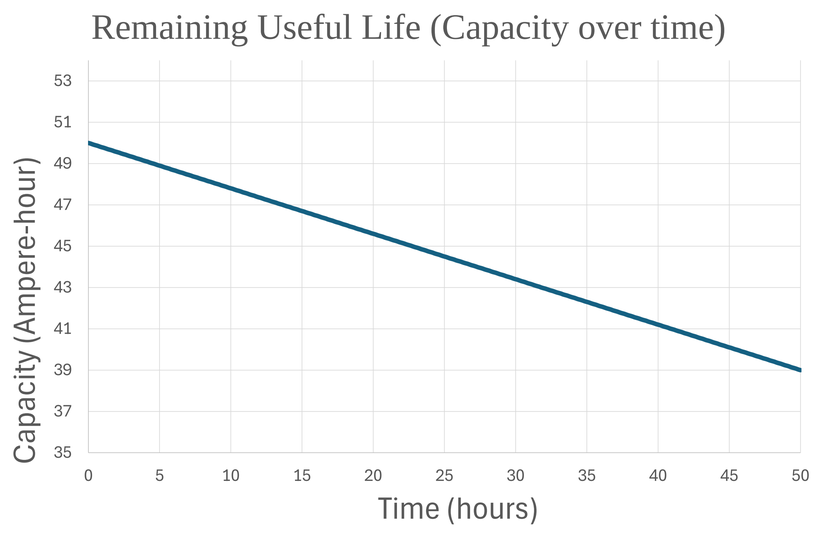
Multi-Domain Electric Aircraft Model



Results and Discussion







- Here is the load profile of a 30-minute flight simulated through the aircraft simulated 100 times over serving as the wear and tear on the battery
- The battery is recharged every time it reaches 30% charge which can be seen in the state of charge graph.
- With a degradation constant of 2% every cycle modeled into the remaining useful life subsystem, this Remaining Useful Life graph is produced
- These results show how the battery is affected based on the flight load.
- Next the Remaining Useful Life subsystem is changed to reflects different degradation rates at different charges

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AFRL Air Force Office of Scientific Research