| Battery cooling control  |
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| Type of assignment: | Bachelor Project |
| Target audience: | Mechanical Engineering |
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InMotion has developed a battery cooling technology which is currently being implemented in a prototype endurance race vehicle. This technology consists of a coolant loop with a water/glycol mixture, which flows through the battery pack. In order to increase the cooling capacity of the normal loop, a refrigerant loop is added.

Both of these loops together can consume a lot of electrical energy, decreasing the efficiency of the vehicle. The purpose of this bachelor project is controlling the pumps and compressors in such a way that the minimal amount of energy is spent while still achieving the battery temperature requirements. The general approach for this project is the following:

Creating a simplified equivalent circuit battery model including controllable thermal effects with the purpose of designing a pump controller for smart battery cooling.

This Bachelor Project combines battery electronics, thermodynamics and control system theory into one. The outcome of this engineering project should be a pump/compressor controller, which changes the pumping speed according to the thermal needs of the battery modules. The project can be split up in 4 sections.

1. Creating the equivalent circuit model. This model represents the actual battery used in the new endurance race car. It needs to electrically and thermally configured in the same way as the battery modules used in the car.
2. Implementing thermal effects. The model mentioned above only covers the thermal behavior of the Lithium-Ion cells. The thermal effects of the cooling needs to implemented in the above mentioned model.
3. Designing a pump/compressor controller. After the finalization of the battery model, which includes the thermal cooling effects, a controller needs to be designed. The pump controller needs to secure that the pump delivers a pre-determined pass flow, which keeps the batteries in their optimal temperature range as good as possible.
4. Testing the controller. To verify the working of the controller tests are needed. There are multiple ways to test this control system. A testing plan is needed for the chosen test technique. If the testing does not fit inside the timeframe set by the educational institution, test data can be shared with the student afterwards, if this is required.