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The overarching aim of the project is to create a platform for a stage spotlight with the behavior expected of such a system in regards to its movement characteristics.

As the mechanical platform is provided, the project can be resolved using the fields of study connected to this project, which are; control engineering, digital system design and embedded programming. The problem statement is therefore divided by field of study.

**Control Engineering** Model the system such that a controller can be designed and implemented from said model. Design a controller such that the performance specifications are met in a satisfactory manner.

**Digital System Design** A communication protocol should be designed and implemented on the FPGA with SPI as the communication method. Measure velocity and position reliably, such that these can be used to monitor and regulate the system. Control the motors using PWM.

**Embedded Programming** Implement a real time operating system such that it will be able to handle user input while simultaneously controlling the given system consistently.

To properly define the project a set of performance specification regarding the controller design is necessary. These specifications consists of rise time, which is the time it takes to reach a given set point with a threshold. Settling time, which is the time it takes to stay within 1% of the set point indefinitely. Lastly there is overshoot, which is the percentage amount which a system initially surpasses its set point.

which is the time it takes the system to surpass the interval from 10% to 90%

As the use case of the system is as a stage spotlight, the performance specifications need to be rather hard as overshoot and a slow rise time could render the system useless. Overshoot is undesirable as a spotlight is placed rather far away from the stage. Even a 1% overshoot would result in a sizable overshoot of the intended target which could potentially be disruptive to the stage show. Furthermore the system needs a rise time as fast as possible without overworking the motors and gearing.

A rise time of 1 second fits both criteria, as this should not need a unrealistic amount of current for the system to react nor should it react so slow it causes a noticeable lag to the stage light. The settling time is set to be 1.2 seconds as this gives the system time to slow down when it is approaching the target and settling in to 1% of the reference. To limit the scope of these specifications they will only apply for movement up to 90°

The performance specifications for a 90° movement are listed below:

Overshoot	0
Risetime	90% of set point at 1s
Settling time	1.2s

**Table 1:** *Performance specifications*

ved godt det er sent, men er det ikke meget høje krav? plus hvis afstanden stor, så er krav for risetime og settling time jo mindre? Plus det medvirker også bare til et endnu større behov for d ledde for at minimere overshoot?

Risetime 90% ? det ser mærkel ud.