



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

### Senior Design Project Description

<b>Company Name</b>	<i>ASMO - NA</i>	<b>Date Submitted</b>	<i>11/09/2018</i>
<b>Project Title</b>	<i>Analysis of Design Tolerancing to Improve Power Window Motor Vibration Performance (ASMO_DC)</i>	<b>Planned Starting Semester</b>	<i>Spring 2019</i>

#### Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

<b>Discipline</b>	<b>Number</b>	<b>Discipline</b>	<b>Number</b>
Mechanical	4	Electrical	
Computer		Systems	1
Other ( )			

#### Company and Project Overview:

ASMO is a subsidiary of DENSO, one of the world’s largest automotive parts suppliers. We manufacture DC electric motors for; Power windows, wiper motors, HVAC blowers, moon roof, sliding panel doors, Radiator cooling fan motors, Power steering assist, rear hatch motors and others. (Please see examples below)



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## Products made in North America



This project will be done with the ASMO North America operation located in Statesville, NC. This facility is a large, high volume facility that supplies motor products to many well-known OEM's such as Toyota, Honda, BMW, etc. Currently, 488 people are employed in this facility and several million motor assemblies are produced here each year.

Demanding performance requirements of today's car manufacturers make performance and quality paramount in this high volume, precision manufacturing environment.

This project will be focusing on the new Power Window motor used in a high variety of cars/trucks produced in North America. From time to time, we encounter higher than normal vibration frequencies on the initial build. We would like to reduce the number of rejects for this type of reject. We will be investigating all component level variability and stack up tolerances in order to determine root cause of the elevated vibration frequency.

### **Project Requirements:**

**Design Problem:** The stack up of all components and their respective print tolerances compared to process tolerances are not consistent to support lowering standard variation and final product performance.

**Objectives:** Analyze how lowering standard variation in component stack up can reduce final test performance rejects. Need to plan what the new process tolerances should be to obtain objective.

This will involve every aspect of making all the subcomponents of the DC electric motor.

### **Expected Deliverables/Results:**

- Outline each manufacturing process in detail. ( process flow)



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- Review current design tolerances and understand the variability that results in variation in product performance specification compliance.
- Develop design changes intended to solve the variability problems within or below the current part costs.
- Outline the current manufacturing tolerances vs. new process tolerances in matrix form.
- Design D.O.E. with parts produced with lowered Standard variation and process tolerances; measured output on final assembly performance tester data.
- Conduct experiments that verify the sufficiency of the design changes
- Goal: eliminate out-of spec variability vibration condition in final motor assembly performance testing.

### **Disposition of Deliverables at the End of the Project:**

Provide to supporter after the end of the Expo

### **List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):**

- Statistical Problem Solving methodology. Know how to set up Design of Experiments. (DOE). Completion of SEGR 4141 with a grade of B or better.
- Interest in precision manufacturing and high volume manufacturing
- Basic understanding of how a DC motor works.
- Basic understanding of machining and pressing operations.
- Ability to make multiple site visits to ASMO's Statesville site
- Good data Collecting methodology.
  - Note: ASMO will support and mentor in areas where team may require help.