Product Specification/Project Plan

EML 4551C – Senior Design – Fall 2011 Deliverable

Team # 27

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Introduction

The emphasis of this project is to design and implement an automated linkage system that can be retrofitted to the current Resin Infusion between Double Flexing Tool (RIDFT) machine that will stably, safely and accurately place the two aforementioned frames, in order to assure optimal vacuum, disassembly and working space. Moreover, this automated linkage system must have an ergonomic handling system. A methodology must also be developed and implemented to accurately place the fiber between the two silicon membranes. These goals must be achieved with a budget of $2,000.00 to $4,000.00.

Product Specification

The modified RIDFT system will be comprised of four significant changes. The first of these modifications is a linkage system, which will be retrofitted onto the current chamber of the RIDFT machine. This linkage will allow for the desired mounting and dismounting stable placement of the metal frames housing the silicon membranes. The second modification is in response to the linkage, it entails the use of a strong dc or stepper motor for the horizontal displacement of the frames and a hydraulic pump that will ideally drive the hydraulic rams which will act as the links. This motor will be attached to a pinion which will be directly inserted to the lower portion of the linkage system. Respectively, the third modification is the control to the motors, which will control the forward and reverse motion for each of the frames, separately. The final modification is to implement a methodology for the accurate placement of the fibers. Ultimately, the primary focus of this project is to improve the processing time when using the RIDFT, while reducing and enabling safe manpower utilization as well as workspace. Once again, it should be restated that these goals must be achieved within a budget range of $2,000.00 to $4,000.00.

To better illustrate the customer's needs and engineering specifications a house of quality figure has been employed below. The x(s) denote that there is a relation between the customer need and the translation into an engineering specification. As previously stated and as seen in the house of quality, the efficiency of the process will be a significant factor in meeting customer needs.

		Engineering Specifications		
		Total Mass	Process Duration	Footprint
Customer Needs	Faster Process Time	x	x	
	Stability	x	x	x
	Quick/Easy Removal of Frame	x	x	
	Mold Placement Methodology	x	x	
	Ergonomic Handling System		x	x
	System Automation		x	x

Linkage System

The linkage required for this system will serve one purpose. To automate the RIDFT process and increase production capability the linkage system will simply remove and replace the diaphragm plates. This linkage is crucial to the automation, as handling the plates is the most difficult part of the entire process. The plates will be moved at one speed as variable speed is not necessary. For our application the linkage system will be made of metal and feature a connection method that allows the diaphragm plate to be easily detached.

A linkage system was chosen because the plates used in the process need to be placed in an exact location to ensure proper sealing. In addition linkages are simple to create once the desired path is known. The linkage will be made of metal to provide sufficient strength and

stability. The system will be driven by an electric motor which will later be discussed in greater detail. The primary considerations discussed when choosing a material for the linkage is Young's Modulus. This characteristic of a metal describes its ability to deform without breaking. Our system will be under many bending moments and torques which the material of the linkage must be able to sustain.

Driving Mechanism

As previously mentioned the driving mechanism for the proposed linkage will be driven by a direct current (DC) or stepper motor that will ideally have built in forward and reverse settings. This motor will be implemented onto its respective linkage by attaching a pinion to the motor which will be inserted into an identically shaped hollow portion located at the end of the linkage. Furthermore, each of the two metal frames will have their respective motor systems. If for any reason the desired motion cannot be achieved through a DC motor, then a step motor will be considered. In addition, a hydraulic system will be implemented with a solenoid valve that allows the user to control the vertical displacement of the frames through the manipulation of each frame's hydraulic ram linkage.

Ergonomic Handling System

Ideally minimal C programming will be required to assure that the each motor can be controlled by a single remote. Within this remote there will be several buttons, two buttons for each motor and hydraulic linkage, controlling the forward and reverse motion. The program will have to read which command is being held and as long as the user holds that command (button) the action will be performed. Of course limits will be set in an attempt to avoid over exertion of the motor, hydraulic pump and linkage. The programming will most likely be performed in Code Warrior.

Placement Methodology

In order to assure that each process is accurately repeatable a coordinate system will be designed for the inside bottom portion of the chamber. This will most likely be implemented by laying out squares and circles in an overlaying pattern centered to the middle of the chamber. By doing this we are providing a consistent location for the placement of the mold, and thus allowing for near identical reproduction of each mold every run.

Project Plan

Gantt Chart/Schedule