USE OF PRESSURE SENSORS FOR STRATEGIC CONTROL OF MOLD FILLING IN LIQUID COMPOSITE MOLDING PROCESS

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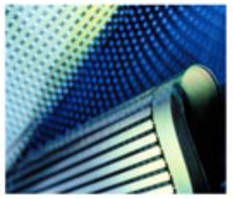
Motivation

Liquid Composite Molding processes such as Resin Transfer Molding(RTM) are one of the most used manufacturing processes for composites. In such processes resin is injected into a mold containing fiber preforms. It is difficult to control the filling step due to the uncertainties associated with the architecture and the placement of the preform.

Several control methodologies have been developed over the past few years. All these methodologies aim to reduce the filling time and dry spot areas. Some of them are now ready to be implemented with appropriate hardware in order to offer a complete control system easy to use for industrial applications.

Objectives

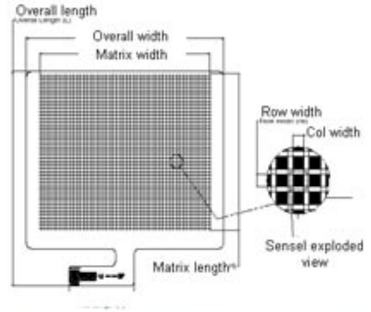
The goal of this project is to implement a strategic control of the RTM process based on a commercial pressure sensor called the TecScan sensor. To achieve this, one needs to get the Tekscan sensor to provide real time data about flow from the pressure values enabling Labview to evaluate the flow front profile on line and take necessary corrective actions (closing/opening gates). The ultimate goal of this feedback loop system is to steer the resin flow front in order to reduce dry spots.



Tekscan sensor

Tekscan Sensor Overview

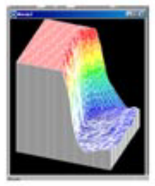
The standard sensor consists of two thin, flexible polyester sheets which have electrically conductive electrodes arranged in a grid pattern, top sheet electrodes arranged in rows and bottom sheet electrodes in column. Squeezed between both layers, there is a thin semi-conductive coating that provides, under applied load, local changes in electrical resistance, which can be calibrated to denote changes in pressure.



Flow Front Detection

The pressure data provided by Tekscan can be manipulated to detect the location of the flow front . The lubrication of fabrics results in a drop of pressure and then a significant increase in pressure which is used to detect arrival of the resin.

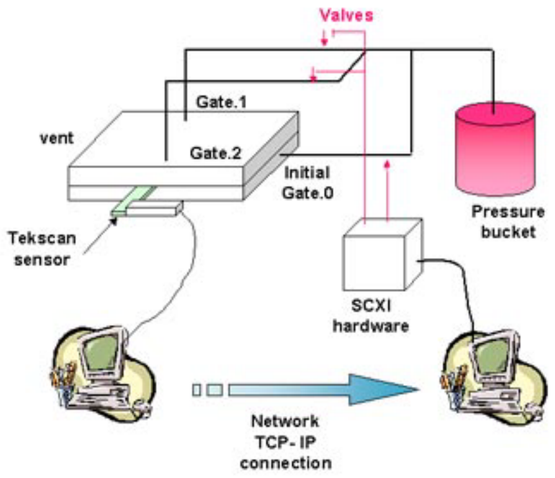
RTM injection movie recorded with TEKSCAN.



Pressure vs time for one sensel

Drop of pressure allowing us to locate the flow front

Experimental Set-Up



Conclusion

Tekscan can be adopted to become a reliable hardware for flow detection and implementation of control strategy to successfully fill RTM molds despite unpredictable disturbances.