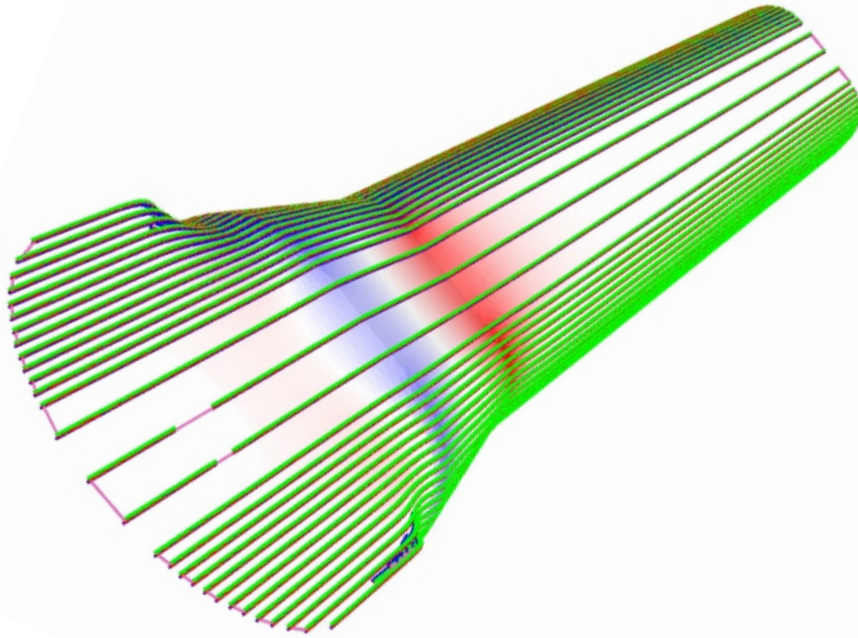




**TD NDE**

*Automated UT Solutions*



## Automated Ultrasonic **Scan Plans**

Full coverage  
Minimum number  
of passes  
Utilisation of part  
geometry & UT  
coverage

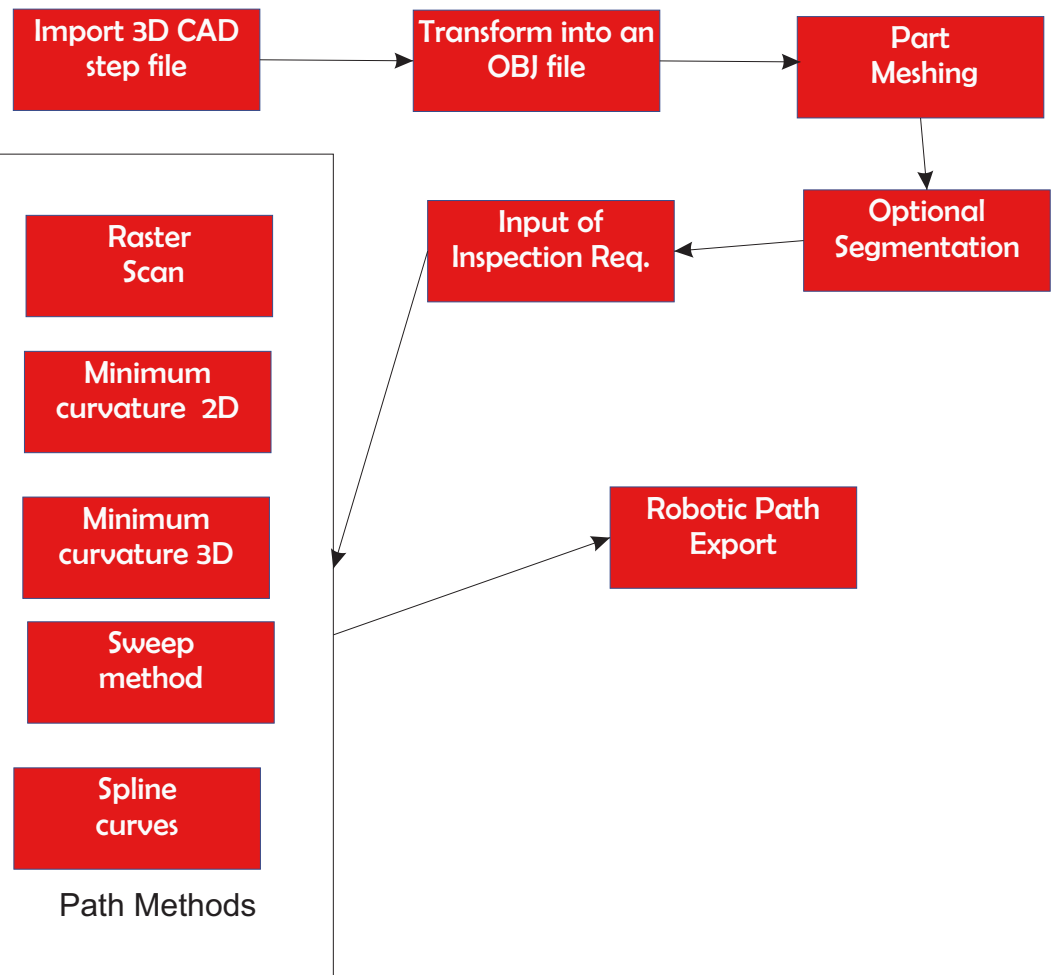
CAD2UT



# Method

## SUMMARY

CAD2UT is an automated software for the generation of ultrasonic robotic paths based on the part's geometry using curvature information. The input is a 3D Surface CAD file of the component to be inspected. The software produces curved surface meshes and minimize area distortions to represent parts in 2D and 3D. A scan path is computed with appropriate scan direction. The distance between successive scan lines is computed based on the curvature perpendicular to the scan direction. The UT probe characteristics are entered to ensure a good coverage as well as a sufficient overlap between passes. The larger the curvature, the smaller the distance between scan lines. The proposed method requires minimal operator intervention while allowing for flexibility in the selection of the ultrasonic inspection parameters.



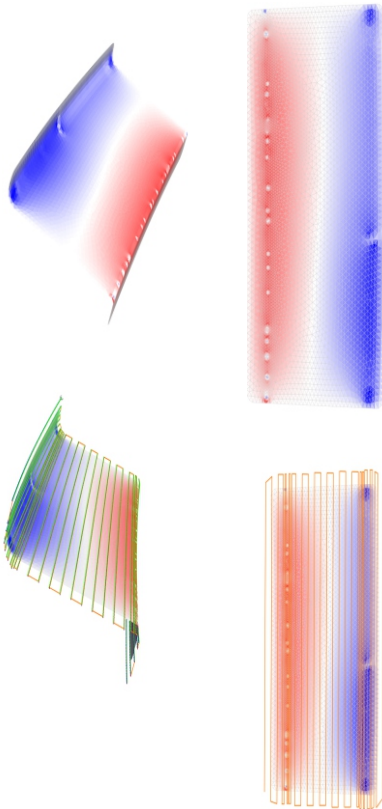
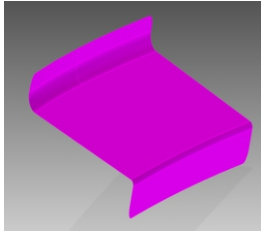
## PATH Generation

Automated  
3D scan  
Designed for UT

## INTEGRATED SOLUTION

UT parameters are taken into account. Scan index changes according to part geometry and required overlap.

## PROCESS FLOW



## Process Details

The CAD file is loaded and meshed within the software. The min, max and tolerance are selected by the user. The software computes a conformal flattening and saves the results as a textures OBJ file format. This results in 2D and 3D files that can be used for generating the ultrasonic path. Distortion is calculated and indicated on the 2D file. The path is generated using the UT parameters: type of probes, methods (PA or conventional), water column, frequency and overlap. Coverage is calculated using these parameters. Using this input, five methods are offered to generate scan plans. This is required as certain geometries are more adapted to certain algorithm. The simplest methods is the raster path which uses the texture (2D) coordinates to create an axis aligned raster path. The distance between successive scan lines is either constant or adjusted based on curvature. The second method generates a path that follows the flattest direction along the 2D mesh. This function figures out the flattest direction using a smooth vector field aligned with the principal directions. The third method is similar to the second to the exception that all work is done on the 3D mesh and that no flattening is performed. The fourth method, named the sweep method, generates on the 2D mesh, a scan line in a highly curved region. Then this line is swept across the part to ensure full coverage. The last methods used the part edge to draw the scan lines. Once completed, the process output the results to a text file or a software for robotic applications.



## AUTOMATED SOLUTION

CAD2UT is designed to assist the operator in establishing scanning plan.

All complex algorithms used by the software are invisible to the operator.



## Software

From the CAD surface drawing to the robot scan plan with some optional modules designed to overcome operational problems.



# automated overall process adapted to various 3D geometries

## FEATURES

- Scan plan directly generated from part geometry with minimal human interventions
- Five methods to adapt to various geometries
- !• Designed for UT
- ! Interface to robotic programming and ultrasonic main instrument

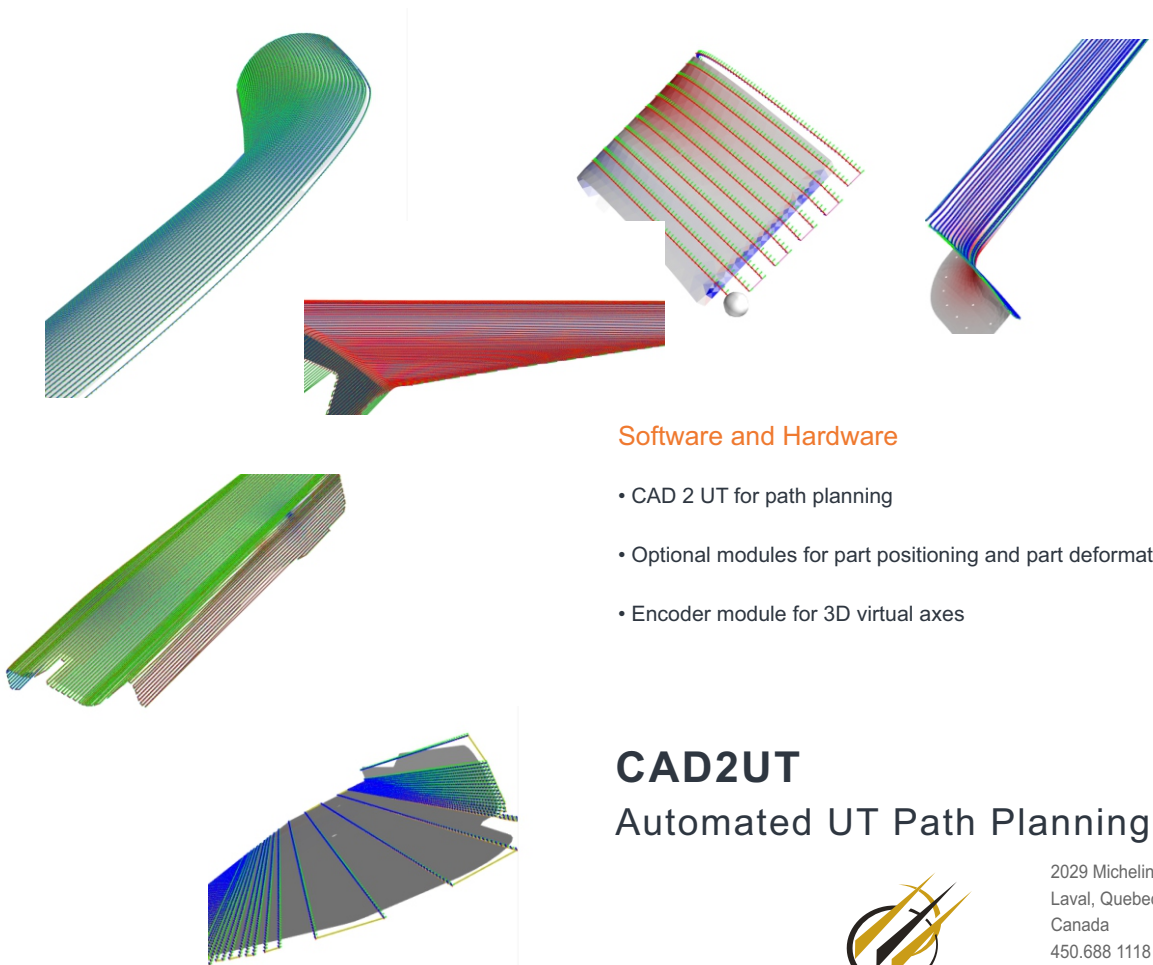
## OBJECTIVE

Designed for UT by UT technicians and engineers. Aimed at automatically build the scan plan that takes hours to do by a qualified knowledgeable operator.

ADDITIONAL MODULES

- **PART POSITION RESET.** For a complex scan, parts must be properly positioned in the scanner for proper inspection. This can be done with a jig but might be difficult to achieve for small productions or some parts. The software uses a special routine to find the part location and applies rotation and translation to all points.
- **PART DEFORMATION.** For a part that is properly located on the scanner, a partial scan of the part leads to a routine that modified the original scan path to match the deformed part. The new scan plan takes in account the deformation of the part routine to find the part location and applies rotation and translation to all points.
- **ENCODER MODULE.** Electronic and software that use the 3D CAD position and path to generate virtual encoded axes for input to UT instrument.

# hardware and software designed for 3D complex scans



Software and Hardware

- CAD 2 UT for path planning
- Optional modules for part positioning and part deformation
- Encoder module for 3D virtual axes

## CAD2UT Automated UT Path Planning



2029 Michelin  
Laval, Quebec  
Canada  
450.688 1118  
[www.tdnde.com](http://www.tdnde.com)  
[info@tdnde.com](mailto:info@tdnde.com)