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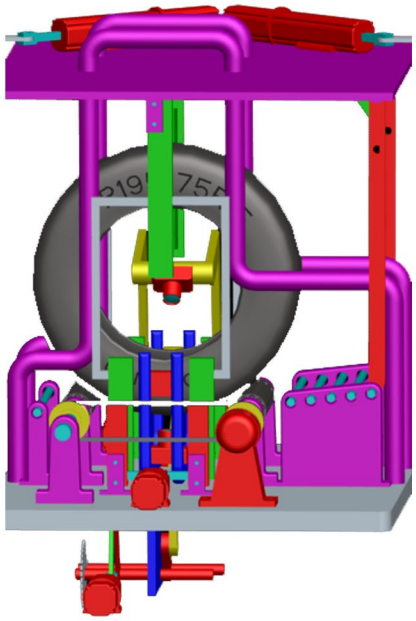
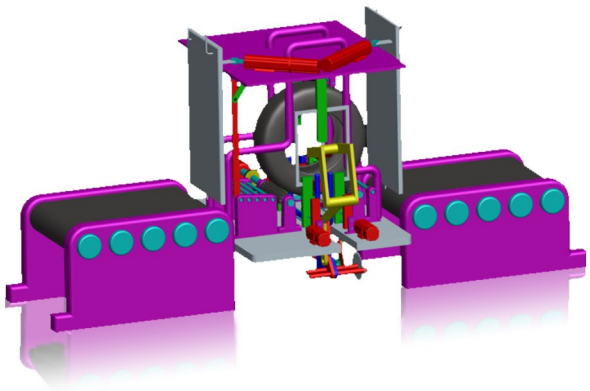
R&D Projects For Tire Industry

Tire Visual Inspection & Computer Tomography for Tire Industry



>> Tire Visual Inspection Machine (TVI)

TVI is a fully automatic visual inspection machine which replaces the manual inspection. It provides full control path internal and external -sidewall and breaker- inspection using two linear cameras. Automatic tire loading, unloading and tire rejecting mechanism are integral parts of the TVI machine. Automatic nonlinear pattern and profile detection and anomaly recognition are also other capabilities of TVI.



By using TVI human errors can be effectively avoided. Human being is a source of failure because of:

> *overlooking a fatal fault.*
> *fluctuation of failure tolerance.*
> *slow and subjective judgment.*

TVI means:

> more safety and reliability.
> quality assurance for the tire industry.
> cost reduction through shorter tire product cycle ad man power reduction.
> enhanced and constant failure judgment.

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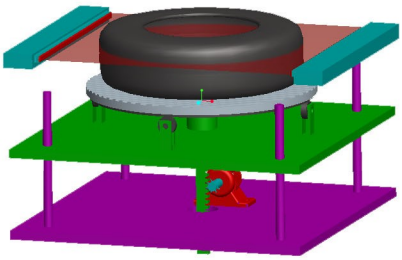
>> Computer Tomography for Tire Industry (CTTI)



The current machines utilize the two dimensional inspection in either Xray or laser.

At JoVision, we are investigating the future of the Tire testing such that 3D data of the tire is measured and any kind of error can be detected.

> Approach

The idea of this project is to develop an effective way for using CT setup and image analysis in tire industry, and thus the most suitable machine design. Until now, there are no machines for tires' CT that can deliver 3D data or 3D images. Therefore, we will model the tire mathematically. This will enable us to generate a database of different tires of known constructions. Additionally, errors can be simulated and included in the model.

The modeled 3D object will be used with different setups of X-ray detectors and tubes. For each setup, data acquiring and detector readings are simulated. The acquired data can be used to reconstruct a 3D model of the tire. Different CT scan reconstruction filters will be applied and verified to optimize the object detection and segmentation of the tire parts.

> Steps

1- Object Modeling: A mathematical model of the tire will be developed and then viewed by VRML (Virtual reality Modeling Language).

2- X-ray Tube and Detector Setup: The X-ray tubes and detectors have several emission patterns, power values and arrangments. This is decided according to the next steps and the minimum cost.

3- CT-Scan Simulation: The determining parameters for the simulation are the angle step and the slice width. Beam attenuation that depend on the tire substance can be estimated.

4- Reconstruction: Different filters and reconstruction methods can be used. The optimum filter is to be researched and used along with the well-established CT-scan theory for reconstruction.

5- 3D Image Analysis: The simulated reconstructed 3D images will be analyzed taking into consideration different error sources as artificial irregularities and reconstruction noise. The analysis processes includes 3D image segmentation, tire parts detection and anomaly detection of different known errors.