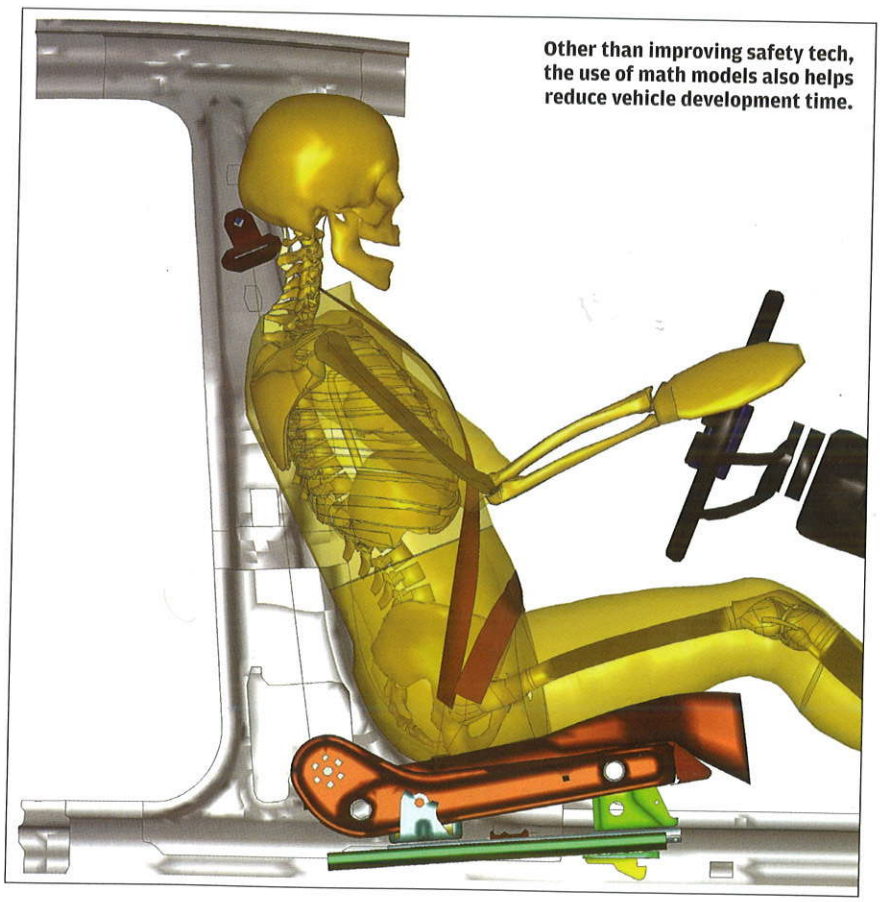
GM's India Science Lab does its bit for safety

State-of-the-art unit is working on human body math models which can eliminate ATDs used in crash tests. **Murrali Thalor** visits the high-tech centre in Bangalore.

The Bangalore-based India Science Lab (ISL), part of General Motors' Technical Centre India, is working towards a significant milestone in the development of human body math models which would help in better injury prediction upon automobile impact and further advance the state-of-the-art knowledge in crash safety technology. The use of math models has the added advantage of reduction in vehicle development times. ISL, which was set up about seven years ago as a centre with core competency in developing advanced math based tools and methods, is working on 20 to 25 fields that are classified as a centre of expertise.

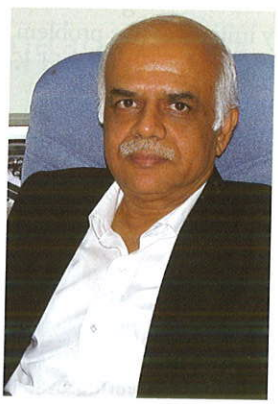
Dr Prakash Bharati, director of ISL and chief scientist, R&D India, Global Research & Development, says ISL has been actively working on the human body math models for some time and this, "will change the way vehicles are designed from the safety perspective. It will facilitate vehicle manufacturers in accurate measurement of forces that human body experiences in an unlikely event of accident." The human body math model can eliminate the conventional dummies - Anthropomorphic Test Devices (ATDs) that are currently used in crash tests. It is a long process and the lab is working on a five- to 10-year horizon. This is because several aspects of human body have to be converted into math-based tools to arrive at a human body math model, which will be the nearest to human beings.

Currently, crash tests are performed with ATDs. Though these tests help vehicle manufacturers to design a vehicle that is safe for occupants, ATDs are still relatively gross approximations of the human body. One step towards bridging the gap between realistic human body injury response and ATD response is to develop math models of the human body for use in automotive impact simulations. Towards this goal, a consortium of vehicle manufacturers and suppliers is working to develop human body models.



Other than improving safety tech, the use of math models also helps reduce vehicle development time.

GM is part of the consortium in which most of the global OEMs and major Tier-1 companies are members. The development is done in two stages – pre-competitive research and company specific research. While the consortium works on developing human body math models till it reaches a reference point, which is the pre-competitive stage, individual companies will take it forward based on their specific requirements and applications.



Dr Prakash Bharati: "This will change the way vehicles are designed from the safety perspective."

From math to market

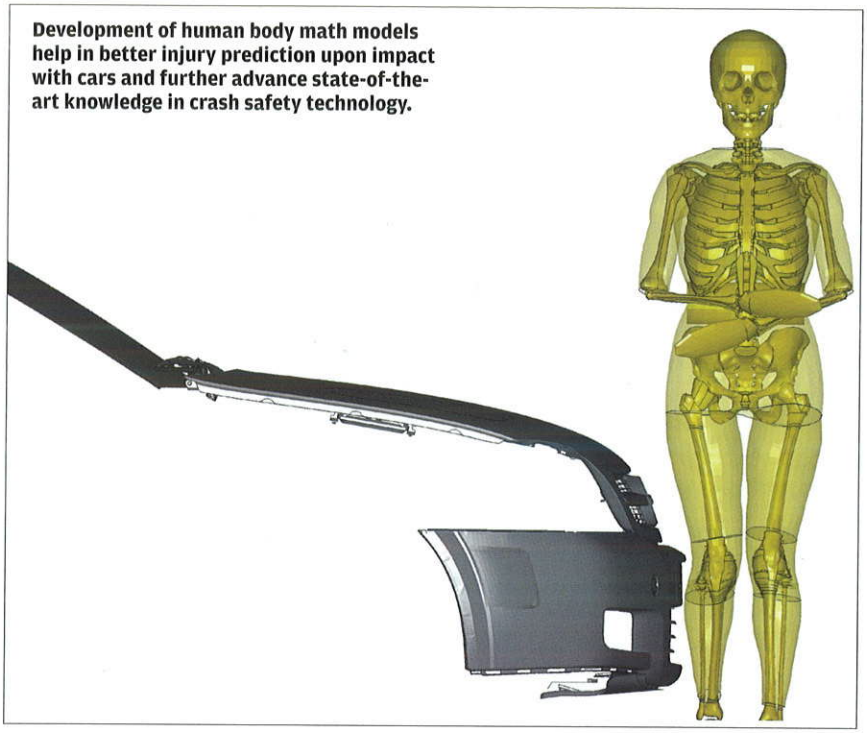
According to Dr Bharati, "The world is moving towards virtualisation of everything and the buzzword is from math to market. Manufacturing processes are getting converted from more metal to math," and this is due to changes in manufacturing

processes and also due to the dire need of OEMs to contain vehicle development process time." Vehicle development time that was from 30 to 34 months earlier has now been reduced to 24 months. The challenge now for global automakers is now to reduce it to less than 16 months. Yet another challenge is not only in squeezing time but also in addressing several issues relating to scale, variations and changes happening in vehicles, says Dr Bharati.

He adds that the car is being transformed from a mere mechanically driven vehicle to an electrically and electronically driven device. To address the transformation, GM has taken up an initiative devised to leverage the transformation itself. Since one of the major emerging areas is ECS – Electronics, Controls and Software – the global company has designated its technical and R&D centres based on the inherent capabilities. And ISL is primarily focusing on software.

Five years ago, high-end cars had 25 to 30 electronic control units with software lines of codes running up to one million. And these were largely not for safety critical applications. By 2013, the average car will have 60 to 65 electronic control units with 100 to 500 million lines of software codes.

The average time taken by a software engineer to write a line of code is dependent on a number of parameters, including level of reuse, level of complexity and language, and it will be difficult to quantify without further classification. However, a software engineer writing a high quality medium level complexity program could produce about 30 to 40 lines of code per day. Therefore, the challenge is not only in generating the volumes of codes but also based on the destination as the end application will be in several safety critical applications including steering, brakes and throttle control.



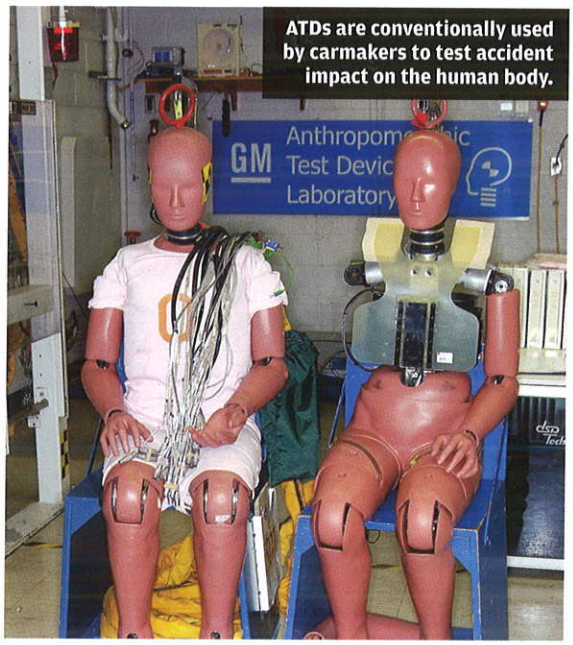
Development of human body math models help in better injury prediction upon impact with cars and further advance state-of-the-art knowledge in crash safety technology.

"There is a shortage of software engineers to achieve 'correct by construction software' in a conventional way. GM counts on ISL for correct by construction software," says Dr Bharati.

The IVHM initiative

Yet another major initiative that ISL is involved is Integrated Vehicle Health Management (IVHM). This Centre of Expertise is led globally by Dr Bharati and IVHM will help vehicle manufacturers to reduce warranty issues significantly while also enhancing customer satisfaction index substantially.

This is so because the concept is a combination of prognosis and diagnosis and the vehicle will be capable of communicating its problems and alerts for preventive maintenance. The vehicle data, retrieved through diagnosis, is combined with a physics-based model, which will enable OEMs to scientifically predict failures much before they occur. "This is like a Total Preventive Maintenance concept, which GM implemented at its plant several years ago. Now the global company is extending this to vehicles with ISL leading the research. It is going to be a major game-changer," says Dr Bharati. Recently ISL completed the research on IVHM and moved to the implementation stage.



ATDs are conventionally used by carmakers to test accident impact on the human body.

The place for automotive engineers

ISL has 20 to 25 Centres of Expertise at different levels of maturity. "Going forward," adds Dr Bharati, "our aim is to make the lab a coveted place for automotive engineers to join and be the 'go to' group for corporations," he says. In the manufacturing space, ISL is looking at computational geometry related aspects of manufacturing.

In addition to ISL, General Motors' Technical Centre India has an engineering division that works on several verticals including powertrain. Currently ISL has about 100 scientists and the engineering division has over 1,500 engineers.

Globally, GM R&D works in six core competency areas such as materials and processes, manufacturing systems, powertrain, chemical and environmental sciences, vehicle development and electrical controls integration. Since ISL specialises in development of advanced math-based methods and tools, it cuts across all the six core competencies.

GM R&D works in seven locations across the world - three in the US (Warren, New York, Silicon Valley) and one each in Germany, Israel, China and India. ■

30 SECONDS ON... GM TECH CENTRE - INDIA

General Motors' Technical Centre - India is a 100 percent subsidiary of General Motors Corporation USA. This centre at ITPL Bangalore houses the R&D and Engineering Centre that will focus on engineering and research and development work in support of GM's global portfolio. It conducts projects for export in critical areas such as computer-aided design (CAD), computer-aided engineering (CAE), computer-aided manufacturing (CAM) and Electrical Technology support and adds to GM's engineering capability in Asia-Pacific, complementing similar technical centres in Australia and China.