"Ideal, ordeal, new deal"

Headline

Snapshot

Background

Automotive seating systems traditionally are built around complex multi-piece, welded steel seat frames that are "trimmed" with moulded foam and fabric.

existing automotive seating products, which are currently fabricated from multiple sub-assemblies based upon a steel frame.

The problem

Weight, number of parts, manufacturing complexity

Prior solutions

Composite materials are attractive for automotive and aerospace applications because they combine strength with low weight. However, the use of composites to create relatively complex configurations such as automotive seating products is expensive. For this reason, composites have found only niche automotive application where cost is of secondary importance to weight, for example in up-market vehicles (e.g. Austin Martin) and motorsports (e.g. Recaro seats).

Shortcomings

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The new solution

enable the creation and production of composite car interior products (initially seating) that provide all the functional benefits (including weight savings) of composites *but are also competitive in price* to existing general use products.

innovative concepts and achievements that are culminating in a potentially game changing technology in applied composites.

The proposed composite seat frame technology uses a 3D knitted reinforcement preform using state of the art commercially available 3D knitting machines. Fibre orientation is controlled by the design of the knit with particular attention to controlling the fibre gauge, direction and density in highly stressed or load bearing regions of the structure. The preform is knitted with a reinforcing fibre and is combined with a thermo-set plastic to produce a preform. The preform is then either inflated with air pressure or injected with foam to make the part take its final design shape. Control of final product geometry is achieved by the use of simple mould tools that are fitted with heating platens. The part is cured in the mould and does not require any post cure treatment or autoclave process.

Features

The product of interest is a passenger vehicle seat that incorporates novel and patent protected technology utilising a 3D knitted composite. A composite “shell” is created by knitting a reinforcing fibre that is engineered with a specific knit construction in the load paths of the structure and is combined with thermoset resin and inflated in a mould to make the part take its shape.

Benefits

There are 5 key benefits of the composite technology including: (1) mass reduction, (2) reduced cost and processing time, (3) design and material composition flexibility, (4) reduced logistics cost and complexity, and (5) reduced tooling and capital equipment costs. In the seat frame application there are additional benefits including the opportunity to integrate features such as stylised trim surfaces and slim cushion pads.

The immediate attractive feature of the product technology is that it is highly suitable for meeting the demands of improved fuel efficiency via reduced mass. However another significant advantage is that the 3D knitted composite product lends itself to a ‘hub and spoke’ manufacturing strategy where the knitted preforms are manufactured in a central location and the final processing is carried out at the final assembly location. The concept is transport friendly with the ability to efficiently sea freight the “uninflated” seat frame structures. The moulding process uses low cost equipment with low cost tooling. With low cure times this final processing to produce a structural component will be inline with the final

assembly process. The low cost of tooling and processing equipment also allows for the manufacture of low volume niche products providing significant differentiation over conventional seat structures.

4 of the 5 key benefits of the composite technology are attributes with a direct positive environmental and sustainability outcome: (1) mass reduction, (2) reduced cost and processing time, (3) design and material composition flexibility, and (4) reduced logistics cost and complexity. These attributes affect improvements in vehicle fuel economy, reduced manufacturing and logistics energy and materials consumption, and the capability to utilise renewable and recycled materials. Hand in hand with these positive outcomes there is an associated reduction in green house gas emissions and significantly reduced waste output.

Future enhancements and features

This is a technology that may be applied to not only automotive structures but all manner of structural applications where cost competiveness, reduced mass and rapid manufacturing capability are highly sought after attributes.

The delivery of a composite seat structure creates an opportunity to position Australia, and Victoria, as a world leader in lightweight, low cost composite structures. The potential market for such structures is large and could capture a significant segment of the multi-billion dollar global automotive market. The technology could also be applied to other industries such as marine, aerospace and civil structures markets.

Summary and soundbites

Mention relevant national research priority

Collaboration – Global, local

The entry level opportunity for the composites technology is in the seating structural products, targeting vehicles where reduced weight and high fuel efficiency are the priority - typically the compact, small and medium vehicle platforms. These segments have global forecasts of 47 to 52 million vehicles p.a. during the launch period of 2012 to 2014. The emerging electric car segment within this is potentially a “soft entry” point for the composite technology.

The commercialisation of the 3D knitted composite technology is expected in 3 stages - a local Australian introduction, then a regional introduction with the final stage a roll out to the global seating market. Thus given successful market penetration, the environmental and sustainability benefits of this product will be appreciated both on a local and global scale.

Publications

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