



Customized assembly support from the 3D printer

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Ergonomic production - Pilot project at the Munich plant evaluates application of individual orthotic devices in vehicle assembly
Munich. The BMW Group considers people the key to a lean production that focuses on the customer benefit. This is why the company interprets "Industry 4.0" as a way to make reasonable use of technologies in order to provide the best-possible support to the workers in production and in support areas. How this can be achieved is demonstrated by a pilot project in Plant Munich's vehicle assembly. Only recently, a new and innovative ergonomic tool has been introduced: a flexible finger cot, which protects workers against excess strains on the thumb joints while carrying out certain assembly activities. The project is part of a dissertation in cooperation with the Department of Ergonomics at the Technical University of Munich, which is a way for the BMW Group to address and meet the specific demands of an ergonomic production. Each of the flexible assembly aids is a unique piece, customized to match the form and size of a worker's hand. The BMW Group makes these orthotic devices in-house, using additive production procedures that are currently the talk of the town, namely "3D printing".
The innovative orthotic devices are applied as part of a pilot project in an assembly area where rubber plugs are fitted. These have to be pressed in with the thumb and close, among other things, the drain holes for the paint coat. Even for people with strong hand muscles, this movement requires a certain effort. In order to prevent the unnecessary overstretching of the thumb joint, the finger cots made of thermoplastic polyurethane are put over the thumb like a second skin. Right at the thumb joints, the assembly aid is open to allow the thumb to move without restriction. At the back of the thumb, though, the plastic material is reinforced. If the thumb is stretched, as in a like-it gesture, the reinforced elements collide, forming a stable splint. This way, the effort needed to press in the plug is spread across the entire thumb, down to the carpus. In initial practical tests, the feedback of workers was very positive. It is currently being evaluated how the assembly aids can be applied as standard tools in further production areas.
Each of these finger cots is made specifically for its user. To this end, the worker's thumb is measured with a mobile 3D hand scanner. Based on a standard production layout, the future orthotic device is then computed and divided virtually into individual layers. Layer by layer, each of them about as thick as a human hair, the tool is then manufactured in a selective laser sintering process. Put simply, the way this additive production procedure works is similar to a 3D printer: A digital data set is cut into individual layers of information. Based on the layer data, a plastic powder is selectively fused by a CO2 laser in a pre-heated construction chamber. This way, the plastic does not only mold into the layer presently created, but also merges with the previously formed one.
Thermoplastic polyurethane, the material used, is perfectly suited to making flexible orthotic devices. As a rule, it is elastic, but forms solid and rigid combinations at higher material strengths. The mechanical tensile strength is high, ensuring that the material can resist also strong, continuous strains without tearing. The BMW Group has been involved in research projects that have recently resulted in the market maturity of the highly innovative material, following several years of development. A major benefit: The mechanical component properties can be customized for the respective application via a combination of different process parameters.
Rapid prototyping for the benefit of people: Seats for Paralympics basketball players
This is not the first time that the BMW Group is applying its expertise in additive production procedures to making ergonomic aids. One example: Back in 2012, the automotive manufacturer produced customized wheelchair seats for the British basketball team competing in the Paralympics. Compared to conventionally made seats, the innovative seats were considerably lighter and also an ideal fit for the athletes, a major advantage for the players.
BMW Group - A pioneer in additive production procedures
The BMW Group has applied additive production procedures for rapid prototyping in concept prototyping since 1989 and has developed the process further ever since. Depending on the specific component requirements, the BMW Group uses different procedures and materials. Besides selective laser sintering, these include stereo-lithography, polyjet printing, fused deposition modelling, and stream smelting of metals. The Rapid Technologies Center at the BMW Groups Research and Innovation Center (FIZ) in Munich produces close to 100,000 components a year using these methods. The range includes anything from small plastics holders to design patterns and vehicle components for functional tests. Depending on the procedure and the size of the component, components might be available within only a few days. They are applied in vehicle development and testing, as individual provisions in production or in high-strain sections in the BMW Groups DTM (German Touring Car Masters) vehicles. It is low volumes in particular that can be made at economic costs using additive production procedures as these do not require any forming tools.
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The BMW Group
With its three brands BMW, MINI and Rolls-Royce, the BMW Group is the world's leading premium manufacturer of automobiles and motorcycles and also provides premium financial and mobility services. As a global company, the BMW Group operates 28 production and assembly facilities in 13 countries and has a global sales network in more than 140 countries.
In 2013, the BMW Group sold approximately 1.963 million cars and 115,215 motorcycles worldwide. The profit before tax for the financial year 2013 was ? 7.91 billion on revenues amounting to approximately ? 76.06 billion. As of 31 December 2013, the BMW Group had a workforce of 110,351 employees.
The success of the BMW Group has always been based on long-term thinking and responsible action. The company has therefore established ecological and social sustainability throughout the value chain, comprehensive product responsibility and a clear commitment to conserving resources as an integral part of its strategy.
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Drei Marken, ein Anspruch: immer noch besser zu werden. Dank unserer kompromisslosen Ausrichtung am Premiumgedanken und am Nachhaltigkeits-Prinzip begeistert die BMW Group heute weltweit mehr Menschen denn je. Wir stehen vor enormen Herausforderungen: Die Welt verändert sich mit hoher Geschwindigkeit. In vielen Ländern bleibt individuelle Mobilität im Fokus politischer Regulierung und nationaler Industriepolitik. Der Wertewandel in der Gesellschaft erfordert neue Mobilitätslösungen. Volatilität ist längst Teil unseres unternehmerischen Alltags. Die hohe Staatsverschuldung und die Euro-Krise verunsichern Märkte und Verbraucher. Mit der Strategie Number ONE richten wir die BMW Group in einem veränderten Umfeld auf Profitabilität und langfristige Wertsteigerung aus ? technologisch, strukturell und kulturell. Im Jahr 2007 haben wir damit die Weichen für eine erfolgreiche Zukunft gestellt und setzen Maßnahmen in vier Säulen der Strategie um: Wachstum, Zukunft gestalten, Profitabilität und Zugang zu Technologien und Kunden. Unsere Aktivitäten sind dabei weiter auf die Premiumsegmente der internationalen Automobilmärkte ausgerichtet. Die strategische Zielsetzung reicht bis in das Jahr 2020 und ist klar definiert: Die BMW Group ist der weltweit führende Anbieter von Premium-Produkten und Premium-Dienstleistungen für individuelle Mobilität.