

Branched supporting structures made of concrete and fiber-reinforced plastic designed to support heavy loads

The present invention relates to a branching node with high load-bearing capacity made of fiber-reinforced plastic (FRP) and concrete. It is the ideal connecting component for branched load-bearing structures in the field of building and bridge construction. The flexible manufacturing process allows for cost-effective production of different geometries of the support nodes required for the specific application.

- Slim and lightweight components compared to previous nodes
- FRP shell (preform) is also the mold
- Individual design options and geometries possible
- Lower manufacturing costs compared to cast steel
- No corrosion
- Additional arrangement of reinforcement possible
- Connection to supporting elements by means of sleeves or insertion rings



Fields of application

Civil engineering, building construction, bridge construction

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TRL3 - Experimental verification in the laboratory

Patent Situation

EP 3460114B1 granted
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17/003TLB

Service

Technologie-Lizenz-Büro GmbH has been entrusted with the exploitation of this technology and assists companies in obtaining licenses.

Background

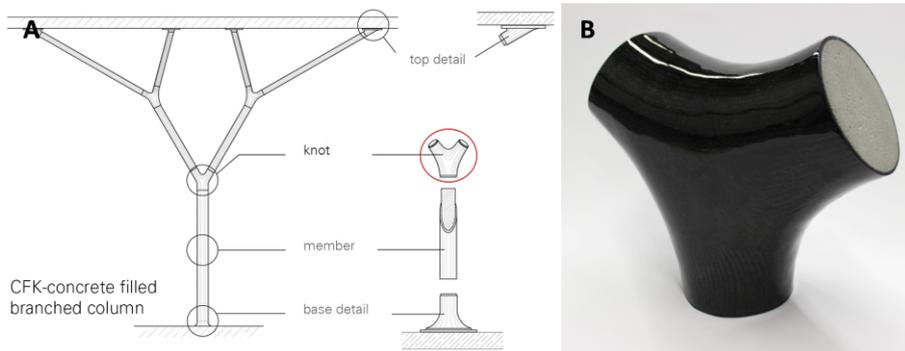
The production of branching nodes as load-bearing structural elements in the field of building and bridge construction is very complex and costly according to the current state of the art.

Problem

Branched load-bearing structures in buildings and structures are characterized by highly efficient load transfer required for the design of slender, aesthetic and resource-saving constructions. Currently, they are often made of steel. For example, steel tubes are joined by means of welded-in slotted plates or cut and butt-welded in the joint area. Branching nodes are also manufactured in one piece as cast steel elements. The above-mentioned solutions have various disadvantages, including limited load-bearing capacity, high requirements in terms of weld seams, complex and expensive production methods, or a limited range of applications. In addition, such branching nodes can often only be manufactured by specialists. Therefore, the availability of such nodes is limited. In principle, branching nodes made of concrete could also be used. But their production is strongly limited by the effort required for formwork and reinforcement. Therefore, concrete branching nodes only can be used when a simple geometry would be feasible.

Solution

An interdisciplinary research team from the University of Stuttgart and the German Institutes for Textile and Fiber Research in Denkendorf has developed a branching node made of FRP and concrete, including the manufacturing process for this novel component. The beneficial properties of the materials FRP and concrete can be used for load-bearing, high-stress structures by means of a form-fitting connection of both components. The newly developed textile manufacturing process enables the production of three-dimensional, continuous fiber-reinforced preforms with a load-adapted fiber architecture on a scale relevant for the building industry. The textile preforms are produced in a braiding process and serve as a casting mold for the concrete core, but also significantly contribute to the structural-mechanical properties of the composite component. The FRP shell is designed according to the expected loads so that tensile stresses can be absorbed. The concrete core mainly bears compressive forces and is additionally secured by the shell. The material combination leads to smaller cross-sections of the supporting elements and thus to slimmer, lighter, and consequently more cost-effective structures. Based on this new manufacturing process it is possible to produce individual geometries with variable leg diameters and lengths as well as angles between the legs. The invention provides a perfect solution for applications in the field of building and bridge construction where load-bearing structures are to be produced simply and cost-effectively.



(A) Simplified application example of structural nodes [ITKE], (B) Concrete-filled CFRP branching node with three legs [Jonas et al. 2019]

Publikationen und Verweise

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