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Design Aspects for DC-HTS Cables in Hybrid-Electric Propulsion Systems for Aircraft

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In 2011 the European Commission presented a report in which Europe's vision for the aviation sector in 2050 is manifested. [1] Amongst others, "Flightpath 2050"set goals for the reduction of the carbon footprint of the aviation sector. Compared to the capabilities of typical new aircraft in the year 2000 CO2 and NOx emissions per passenger kilometer shall be reduced by 75% and 90%, respectively. When taxiing aircraft movements are even supposed to be emissions-free. Another goal is the reduction of noise emissions of a flying aircraft by 65%.
These ambitious goals can only be achieved by innovative propulsion systems and aircraft architectures. Electric and hybrid-electric propulsion systems would allow distributed propulsion by separating power and thrust generation. Even though electric or hybrid-electric propulsion systems are already used in cars, ships and big mining trucks, for example, the challenges for the aviation sector are huge. Weight and size issues play a major role for the design and the efficiency needs to be as high is possible. Highly efficient and lightweight superconducting components could help to achieve the ambitious goals of the aviation sector.
In the framework of the German TELOS-Project, we investigate the feasibility of a High-Temperature Superconducting (HTS) power distribution system for hybrid-electric aircraft propulsion systems and develop a demonstrator cable for DC power distribution. In this paper we discuss different design aspects for the cable and its cryogenic system. Current-lead design, cable-joints and bendability of the cable are important issues and first results of calculations and experiments related to these issues will be presented.

[1] "Flightpath 2050 Europe's Vision for Aviation"Report of the High Level Group on Aviation Research, doi: 10.2777/5026

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