Master's thesis Project proposal

Company name	**Coriolis Composites,** Coriolis Composites: The reference in Automated Fiber Placement (coriolis-composites.com) **with Laboratory for Processing of Advanced Composites (LPAC)** **and Photonic Materials and Fibre Devices Laboratory (FIMAP)**
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Project title or topic

"Multi-material functional fibers integrated into composite structures using industrial scale additive manufacturing"

Context and background

Full time master's thesis project

This project run as a collaboration between EPFL (FIMAP and LPAC), and Coriolis Composites will explore the introduction of multi-material functional fibers (F-fibers) into continuous fiber composites produced by additive manufacturing (AM) and robotic advanced fiber placement (AFP). The objective is to combine structure (via carbon fiber) with increased functionality (via multi-material F-fibers) for light weight structural composite parts, tailored to aerospace, drones or other industrial applications in terms of mechanical behavior and sensing requirements. Functionalities that can be introduced include strain sensing, temperature and humidity measurement, and haptic functionalities at reduced system cost. F-fiber sensors are not currently available to suit automated integration into composites, and the part manufacturing processes are not adapted. Composites rarely contain distributed sensors, as these may not survive the process heat and pressure regime, although fiber optic sensors have been successfully introduced. In addition, while the additive manufacturing of composites is in active development, multi-functional F-fibers have not yet been adapted to these processes in terms of integration methods, precision and connection.

The project will thus focus on the development of an adapted multi-functional drawn fiber, which can survive AFP and AM process temperature and pressure regimes, which bonds well to the composite structure, while minimizing any detrimental effects on composite mechanical properties. This requires the development of suitable material combinations, with adapted rheological properties, to thermally draw these F-fiber sensors. In parallel, we aim to demonstrate multi-material additively manufactured composite parts where strain, local pressure, and temperature can be measured.

For this, industrially relevant AFP and FDM equipment will be used at external facilities that the student would have the opportunity to visit and participate in these trials (Coriolis Composites). With the adaptation of the F-fibers to suit 3D printing processing requirements the door will be opened to direct, automated and precise integration into composite parts which has not previously been achieved. It is anticipated that high quality work will be published and presented accordingly.