

Predicting the breakdown of synthetic braided ropes by integrated textile based monitoring systems (Smart RopEx)

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Mission Statement:

Aim of this project is to develop a textile-based monitoring system that is integrated in synthetic ropes. It will predict the ropes residual life time.

This system is being developed for three new applications of synthetic fiber ropes: elevator-ropes, lifting-slings and winch-ropes. Made of high performance fibers they offer a four to five times higher specific strength combined with an aprox. 30-35% lower weight compared to conventional wire ropes. They are able to outmatch today's state of the art steel wire ropes.

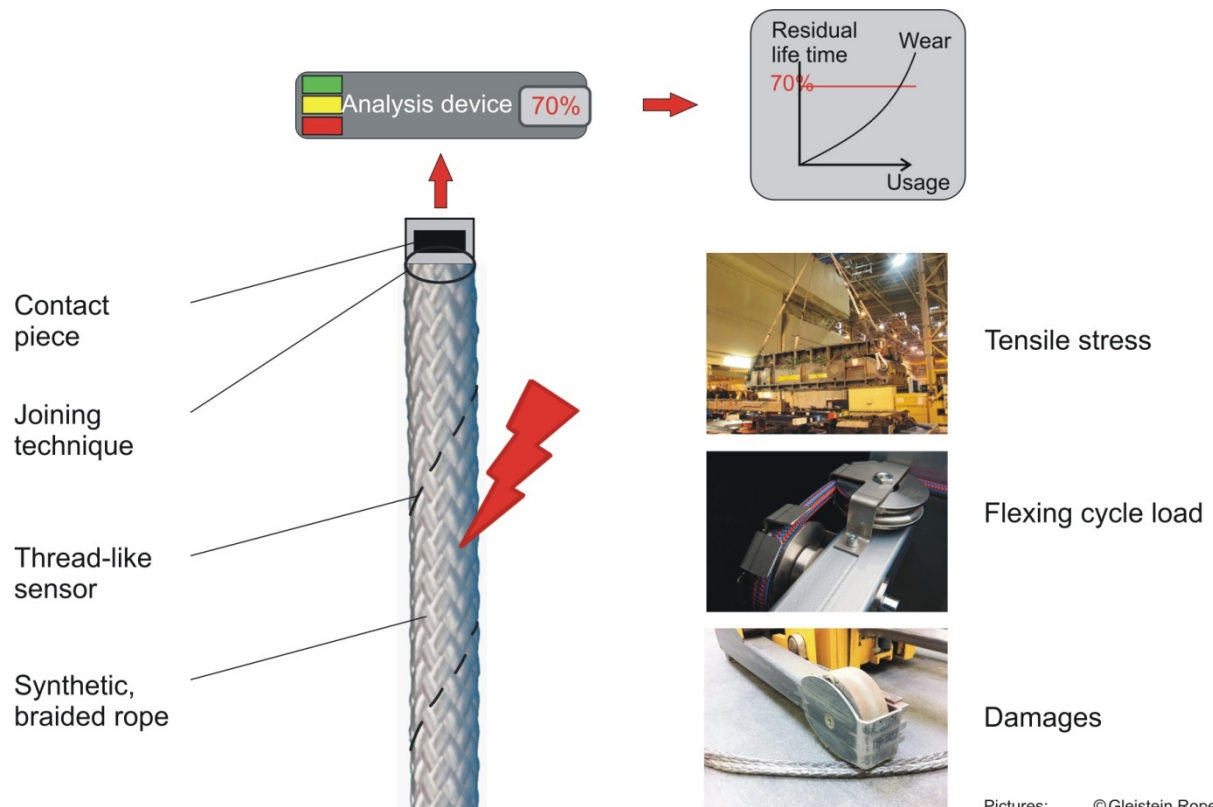
Though they are more expensive than conventional wire rope solutions these new ropes have to keep up with ongoing product developments regarding economic aspects during their whole service life. A non-destructive monitoring, showing the residual life time, could help to utilize the full product life cycle. Additionally the monitoring of the actual load case will lead to increased safety. Both aspects are required for a complete acceptance of synthetic ropes in the market.

Within the project a prototype of the entire monitoring system for each application will be developed, showing the residual life time of the rope.

Therefore the following subgoals have been defined:

- Definition of parameters that can be used to predict the residual life time. The used parameters will be based on the change of electric resistance due to changing elongation. Additionally a statistic as well as a physical breakdown-model of the rope is developed.
- Several thread-like sensors, measuring these parameters, are developed.
- The sensors are integrated in each application in an appropriate way to guarantee an optimal measurement of each parameter.
- A joining technique to connect the sensors to the electronics is developed, using a special contact piece between both.
- An analysis device is developed to actually examine these parameters and show the residual life time of the ropes.

The following graphic shows a general overview of all components:



Smart RopEx

The project aims are derived from achievements of the former project "Smart Rope". In this project monitoring systems were integrated into ropes to improve functional reliability by showing the actual load case of the ropes. But just displaying these conditions does not allow drawing conclusions concerning the residual life time. To do so, actual conditions and service life criteria have to be combined.

To identify the optimal moment to replace the ropes, reliable parameters are essential to calculate the residual life time and are therefore a necessary step towards a complete monitoring system. Hence the grade of occurred damages and the expectable service life will be displayed.

The focus of the developments lies on criteria that can be evaluated electrically. This way it will be possible to gather information about the residual life time by attaching the analysis device each and every time. Ropes could be replaced efficiently and economic just in time: Right before breakdown and not too early. This makes the whole application very efficient and economical reasonable. Cost-value-ratio is perfect for expensive applications like elevator ropes, lifting-slings and winch-ropes and safety is warranted at every point of time.

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