



Hydraulic behavior of a novel cycloidal propeller in natural currents

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The StECon (Stiller Energy Converter), named after its inventor Hans-Ludwig Stiller, is a novel cycloidal propeller with two to six rotating blades for using small kinetic hydropower potentials. With several advantages compared to common hydropower technologies, this energy converter enables the use of potentials, which cannot be harnessed by other systems. It runs completely submerged in both directions and can be mounted vertically as well as horizontally. Equipped with an epicyclic gear with a gear ratio of 2:1, every blade is rotating by 180° around its own axis during a full rotation of the wheel. Due to the freely movable sun wheel of the planetary gear, an optimum position to maximize the energy production can always be achieved, depending on the flow direction. The feasible applications of the StECon are mobile and stationary tide and current generators as well as hybrid solutions. The StECon can either be used as a generator or as a propulsion system. Within a first research project at the Research Institute of Water and Environment (fwu) of the University of Siegen, a prototype of the StECon with a diameter of 50 cm in a vertical realization was built and investigated concerning its performance and characteristics behavior. In a following project an optimized prototype with a greater diameter of 75 cm and improved blade shapes was constructed and investigated under natural conditions in the free current of the river Sieg. To enable the investigations, a raft was built by using several tubes for the needed uplift force. The integrated StECon was tested by utilizing different rotational speeds and phase angles during several flow conditions. Due to its low rotational speed, neither the flora nor the fauna are endangered by the movement of the blades. As a result it could be observed, that the StECon is an ecologically friendly alternative in comparison to widely distributed hydropower technologies to enable the use of kinetic hydropower potentials of free currents.