Nippon Brand Award of 2019 “CHO” MONODZUKURI Innovative Parts and Components Award

Hub Bearing Module with Steering Adjust Function “sHUB™”

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1. Introduction

In order to tackle environmental challenges and create a society free of traffic accidents, new vehicles are being developed incorporating self-driving and electric propulsion to help improve automobile safety and reduce energy consumption.

sHUB™ assists in achieving safety, comfort, and energy-efficient driving in internal combustion engine vehicles, electric vehicles, and self-driving vehicles, by properly applying correct control to the tire angles to suit any situation, with varying speeds.

In recognition of the details stated above, sHUB™ received the Nippon Brand Award of the 2019 “CHO” MONODZUKURI Innovative Parts and Components Award.

2. Structure

This hub bearing components include a steering shaft and an actuator incorporating a linear motion mechanism, fastened to a knuckle, and tires are steered by the actuator’s power, with the steering axis of the hub bearing as the center.

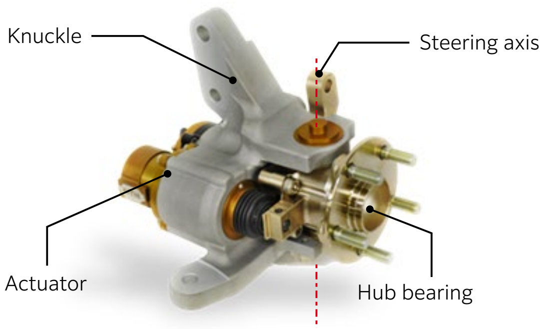

Fig. 1 Structure of the sHUB™

3. Features

The following characteristics of the vehicle shown in **Fig. 2** have been improved by providing control using sHUB™ for the vehicle’s front wheels:

1) Improved vehicle stability when driving straight
2) Cornering performance
3) Safe control of tire angle before tires slip while maneuvering
4) Reduction of running resistance and improved fuel consumption

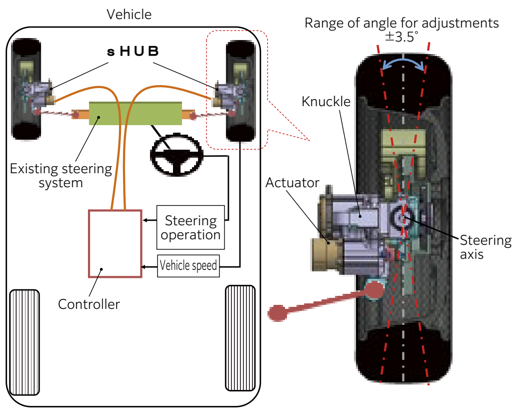

Fig. 2 Vehicle with sHUB™ installed (on front wheels)

4. Summary

We are currently moving toward commercialization and testing is taking place for this product in test vehicles. As indicated in another article in this review we are also working on creating sHUB™ for rear wheels, and we expect to increase automobile safety through the development of new automotive products.

References

1) Norio Ishihara, Hirokazu Ohba, Atsushi Ito, Mitsunori Ishibashi, Makoto Yamakado, Yoshio Kano, Masato Abe, Hub Bearing with Steering Function that Improves Vehicle Dynamic Performance, NTN TECHNICAL REVIEW, No. 86, (2018) 84-90.
2) Satoshi Utsunomiya, Norio Ishihara, Yusuke Ohata, Atsushi Ito, Hub Bearing Module with Steering Adjust Function (sHUB™), NTN TECHNICAL REVIEW, No. 87, (2019) 18-23.

Photo of authors (Representative)

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Micro Hydro Turbine

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1. Introduction

Micro Hydro Turbine **(Fig. 1)** received the New Energy Foundation Chairman Award at the 2019 New Energy Awards hosted by the New Energy Foundation. The New Energy Awards commends products that are outstanding in promoting adoption and raising awareness of new energy. Micro Hydro Turbine generates power by simply placing it in an existing water channel with a flowing current. It is very friendly to the global environment and is contributing to SDGs on a global scale. It is highly regarded because it helps to reduce maintenance costs of irrigation facilities by supplying and selling power at locations without electrical infrastructure.

Fig. 1 Micro Hydro Turbine

2. Product Design

Micro Hydro Turbine is shown in **Fig. 2**. The turbine consists of high-efficiency blades connected to a generator that is mounted on a frame for installation on water channels. There are two types of controllers for power generation; one for charging batteries as an independent power source and the other for connecting to the grid so that generated power can be sold. This versatility allows the product to respond to broad market requirements for power generation.

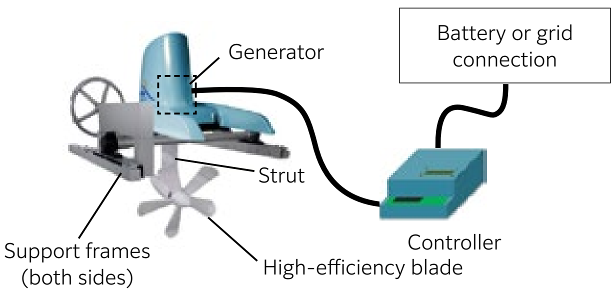

Fig. 2 Configuration of Micro Hydro Turbine

3. Product Specifications of Typical Model

The model with a blade diameter of 90 cm achieves a rated output of 1 kW when the flow rate is 2 m/s **(Table 1)**.

Table 1 Product Specifications of Typical Models

Turbine	Propeller hydro turbine for flowing water
Generator	Permanent magnet synchronous generator
Blade diameter	60 cm, 90 cm, 130 cm
Rated power output	1 kW (90 cm model at flow rate of 2 m/s)
Recommended water channel	At least 100 cm width and depth
Size/weight	H190 cm × W230 cm* × D170 cm, 170 kg

*Varies depending on the width of the water channel.

4. Summary

Ordinary hydro turbines require major construction work to create different water levels. The issue with major construction is its cost and damage to the environment. Micro Hydro Turbine can be installed by simply placing the unit on an existing water channel with the beams fitted to the width of the water channel, with little to no construction costs and environmental impact.

References

1) Tomoya Kawai et al., Micro Hydro Turbine, NTN TECHNICAL REVIEW No. 84, (2016) 28-33.
2) Takashi Ito et al., Grid Connectable NTN Micro Hydro Turbine, NTN TECHNICAL REVIEW No. 86, (2018) 102-107.

Photo of authors (Representative)

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Mechanism for Initiation of Peeling in Rolling Contact and the Effect of Black Oxide Treatment on the Suppression of Peeling (Part 1, Part 2)

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1. Introduction

Papers[1)2)] submitted to the *Tribologist*, the Journal of the Japanese Society of Tribologists, received the society's Encouragement Award for FY2019. The following provides an overview of these papers.

2. Overview

This research examined the initiation mechanism of peeling, a type of roller bearing failure which occurs under poor lubrication conditions, and the effect of black oxide treatment on the rolling contact surface to suppress peeling. In the first paper[1)], a peeling simulation test (RCF test) was carried out with a two - cylinder type tester. The mechanism of initial crack initiation of peeling was investigated based on observation of the rolling contact surface and various analysis results. In the second paper[2)], the repeated stress acting at the true contact point was estimated by examining the rolling contact surface and measurement of residual stress. The relationship with progression of peeling was also investigated. As a result of the above efforts, the following findings were obtained.

① The initial crack of peeling originated at a notch formed due to plastic contact by roughness asperity of the rolling contact surface.
② At the rolling contact surface, maximum shear stress acts in a direction inclined by about 45° from the radial direction. It is likely that the initial crack of peeling progressed due to the action of this maximum shear stress.
③ When black oxide treatment was applied to the rolling contact surface, it promoted a drop in surface roughness (running-in), and the repeated stress acting at the true contact point was lessened. As a result, there was a reduction in the formation of notches due to plastic deformation, and it became more difficult for peeling to occur.
④ In the black oxide product, running-in is promoted by phenomenon where the surface roughness become smaller with black oxide treatment and only the protrusions of the black oxide layer wear during rolling **(Fig. 1)**.

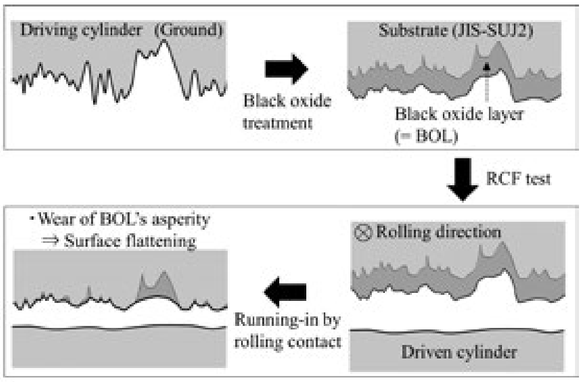

Fig. 1 Mechanism of running-in on rolling contact surface with the black oxide layer [1)]

3. Future development

The findings obtained in this research will contribute to guidelines for the development of life enhancements for roller bearings. Going forward, we hope to make use of these findings to offer users bearings with higher reliability.

References

1) Naoya Hasegawa, Takumi Fujita, Michimasa Uchidate, Masayoshi Abo, Mechanism for Initiation of Peeling in Rolling Contact and the Effect of Black Oxide Treatment on the Suppression of Peeling (Part 1) — Discussion of Crack Initiation Based on Experimental Results, Tribologist, 63, 8, (2018) 551-562.
2) Naoya Hasegawa, Takumi Fujita, Michimasa Uchidate, Masayoshi Abo, Mechanism for Initiation of Peeling in Rolling Contact and the Effect of Black Oxide Treatment on the Suppression of Peeling (Part 2) — Relationship between Progression of Peeling and Stress Under the Rolling Contact Surface, Tribologist, 63, 9, (2018) 618-628.

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