Harnessing the best of both worlds

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Hybrid brakes for wind turbines are often overlooked as a solution, but the benefits of combining active and passive technology in a single product are becoming more widely accepted by some key industry stakeholders.

Brakes are a central component of a wind turbine, and among the most important are yaw brakes (active or passive) that are installed to align the nacelle into the wind. In simple terms, an active yaw brake utilises high hydraulic pressure to keep the wind turbine nacelle into the wind, and low hydraulic pressure in case the nacelle needs to be moved around the vertical tower axis. In contrast, a passive yaw brake system is constantly applying the same force to keep the wind turbine rotor into the wind.

Heavy-duty rotor and pitch brakes are also used in various wind energy applications. Rotor brakes are typically caliper-style (active or passive), while rotor lock pins (hydraulic or manual) are used for safety locking and maintenance purposes.

Then there are high-end coolers, hydraulic systems, cylinders and accumulators. Hybrid brakes are yaw claws that combine active (hydraulic) and passive technology. Passive actuators (mechanical) using plastic pads support the yawing function of the sliding bearing, while active actuators increase the retention torque, reducing demand on yaw gears.

All hybrid brakes are yaw brakes since rotor brakes must always be 100% active. It's also true that hybrid brakes are tailored to each wind turbine generator, more commonly referred to as WTGs.

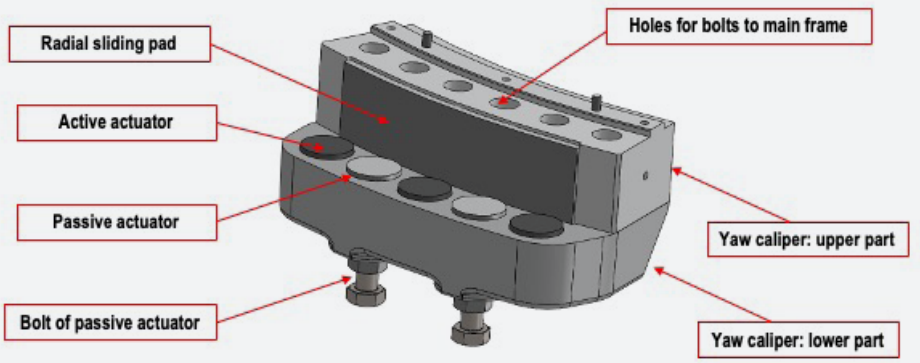
Commonly found alternatives to hybrid brake yawing systems are 100% active brakes, in bearing system configuration; 100% passive brakes or a mix of active and passive brakes, in sliding ring system configuration.

Hybrid brakes have a disadvantage against passive systems, since a yaw hydraulic power unit (HPU) is required. An HPU is a key component in the yaw system of a wind turbine, especially in turbines that use hydraulic rather than electric yaw mechanisms.

Also, as a hybrid system is a structural brake, finite element analysis (FEA) is required to simulate and study how the system behaves under various conditions such as stress, heat, vibration, fluid flow or other physical effects. Regardless, the advantages outweigh the disadvantages, which is why combining active and passive technology in a single product is becoming more widely accepted by some key industry stakeholders.

Among wind energy stakeholders, Siemens Gamesa is one of the main original equipment manufacturers (OEMs) that

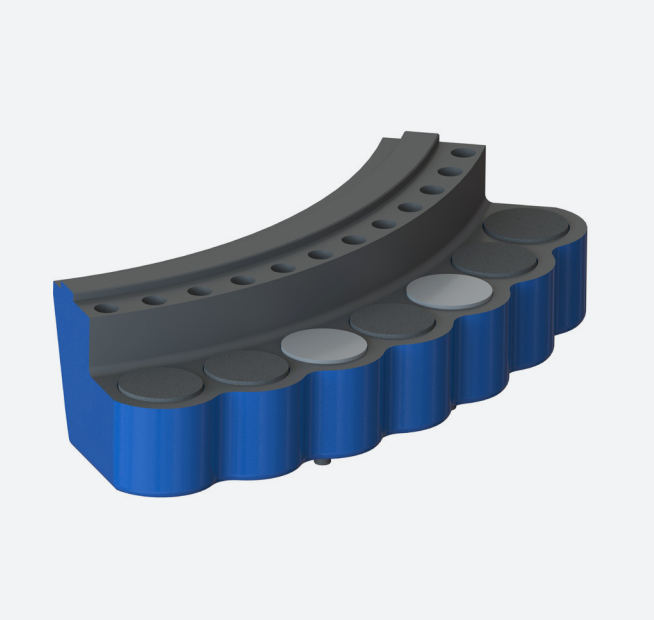
YAW CALIPER - HYBRID CONFIGURATION Definition



- MIXED ACTIVE AND PASSIVE ACTUATORS
- YAW CLAW → STRUCTURAL BRAKE (FEM ANALYSIS)
- ORGANIC FRICTION MATERIAL AND PETP

OPERATION	PROCEDURE
YAWING	Hydraulic pressure (residual value) + + passive force + nacelle weight
RETENTION	Hydraulic pressure + passive force + nacelle weight

Taylor made hybrid brake



G80 hybrid brake

successfully implemented this hybrid brake technology. Standout advantages over separate active and passive systems include reduced cost of acquisition and maintenance on yaw gears; improved torque control; plastic linings in yawing reduce noise risk and lower wear of linings.

Most of today's leading OEMs use a bearing yawing, so implementing hybrid brakes requires them to change design guidelines to sliding-ring yawing, which is a cost-efficient system.

The groundswell of support is growing following the recent acquisition of Antec by the Dellner Group. Antec had previously been forging its own path as a supplier of hybrid brakes, while the Dellner name has long been synonymous with industrial braking expertise, tracing back to the founding of its braking division in 1941.

The acquisition included Antec's existing operations and orders in Spain, China and Brazil, significantly expanding the group's global reach and reinforcing its position in the industry. Antec CEO Pepe Traspaderne has remained in a leadership role, contributing his expertise and vision to the wind team under the guidance of Managing Director Kai Kölker.

In addition to the widely publicized acquisition of Dellner Hydratech, the Danish supplier of high-end hydraulic systems, cylinders and accumulators for wind, offshore and marine applications, other key milestones include the 2018 purchase of Pintsch Bubenzer. This move led to the creation of the Dellner Bubenzer Group, a powerhouse now placing hybrid technology at its core to enhance safety through improved yawing retention.

Traspaderne said previously, 'I am incredibly proud of the Antec business we have built over the years. Joining the Dellner Group feels like a natural step forward for us, and I am excited about the journey ahead. I am confident that together, we will make Dellner Wind and Dellner Bubenzer even stronger, delivering top-quality products and services to our customers as one united family.' And so, it has proven to be true.

dellnerwind.com

See Dellner Wind Solutions at Husum Wind, Germany,

Booth 2E40, 16th to 19th September.

Wind turbine generators

As we know, a WTG is a key component of a wind energy system, responsible for converting the kinetic energy of the wind into electrical power. As wind turns the turbine's blades, this rotational motion drives a shaft connected to a generator, which then produces electricity, typically via electromagnetic induction.

WTGs come in a range of sizes, from small-scale units for residential or off-grid use, to massive utility-scale systems found in onshore and offshore wind farms. Their efficiency and output depend on factors such as blade design, wind speed and generator technology, like direct-drive or geared systems. As demand for renewable energy grows, WTGs play a crucial role in decarbonising the global power grid.

Industrialisation trending

We are increasingly witnessing the industrialisation of WTGs, which is important because, as we explored in the main body of this article, hybrid brakes are tailored to each WTG. This industrialisation is presenting itself in serial production on assembly lines. We're not at this point yet, but there may come a time when such production is ubiquitous, as it is in classic serial production industries, such as the automotive sector.

The backdrop to this is the wind energy industry's ongoing transition to build-to-print from build-to-spec. Build-to-print is the process of building products to a client's work instructions. This method is often employed to make components or items of equipment that will be fitted into a larger machine.

With build-to-spec, the components are created by the manufacturer from scratch, based on their client's requirements. This is very different from build-to-print because the process allows for the development and evolution of solutions to problems. The customer presents the issues they are having or the desired outcomes, and the manufacturer designs something based on decades of engineering know-how, research and development.

Importantly, the manufacturer is involved from start to finish, rather than having a drawing sent via email without a prior discussion about the application at the point of use.