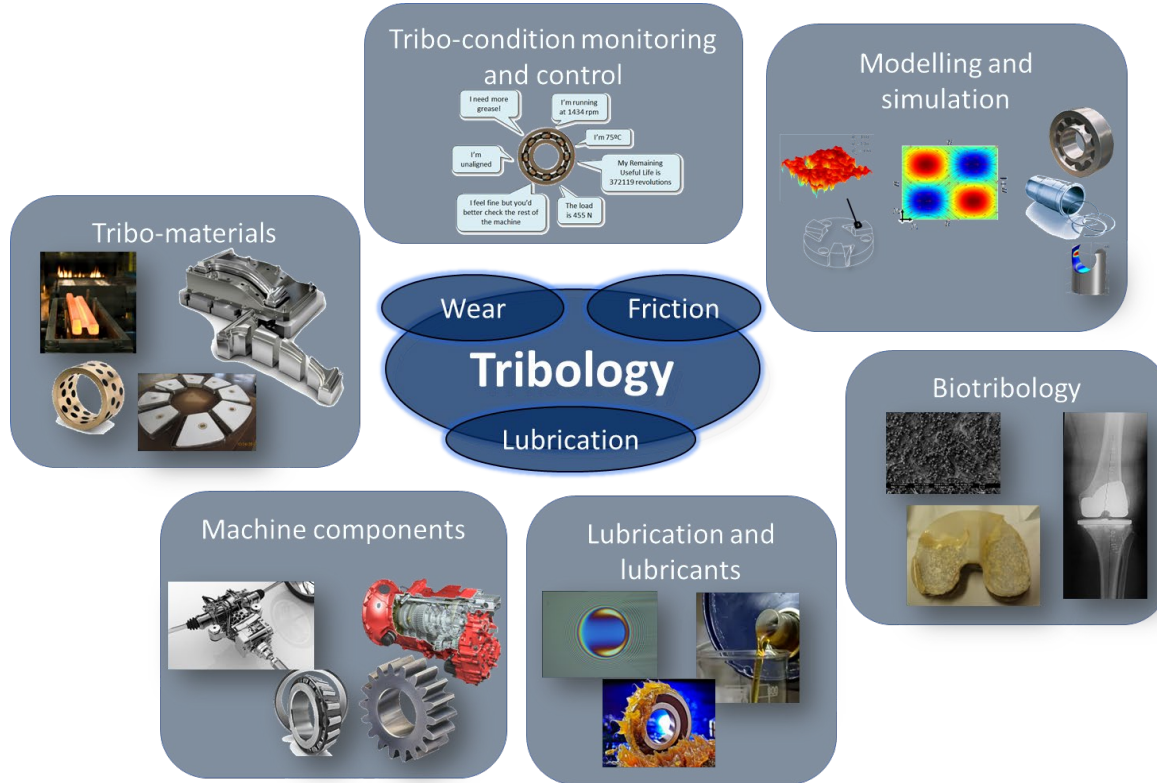


ON THE DIRECTION OF MACHINE ELEMENT RESEARCH IN HYDROPOWER APPLICATIONS

Kim Berglund

Senior Researcher within the Swedish hydropower centre

Research at the division of machine elements



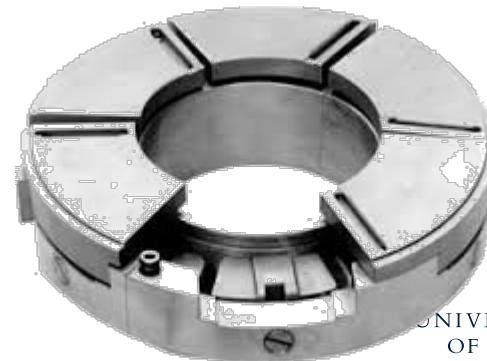
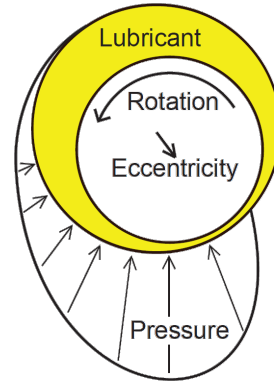
Hydropower research

A historical perspective

Evaluate different types of lubricants and materials to optimize thrust and guide bearing:

Efficiency

Performance



What about current/recent research?

Recent research - Background

Increased environmental demands



Grease and oil



Environmentally acceptable
lubricants and/or materials



Increased demands to regulate power
output

New operating conditions

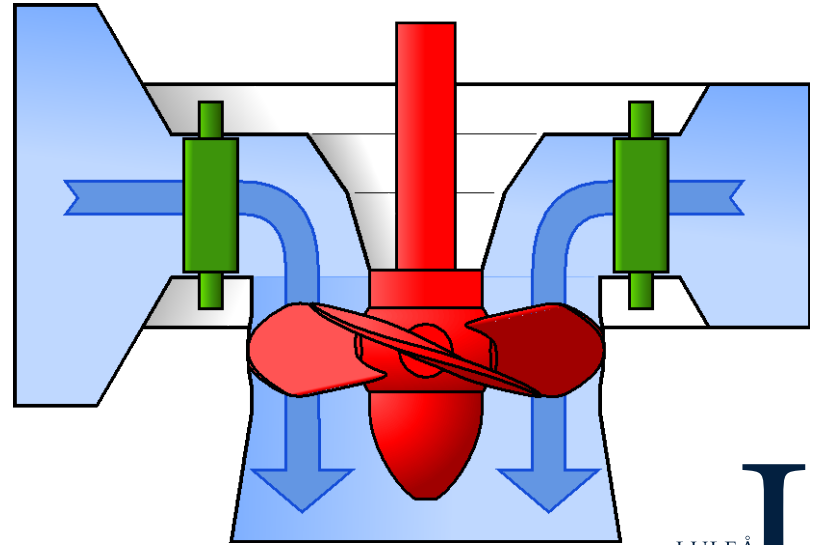
Service life?

Two tracks of research

Environmentally acceptable lubricants and materials



Condition monitoring and predictive maintenance



Recent research – self lubricating bearings

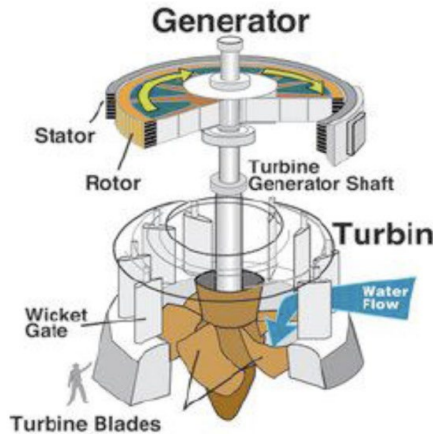
Increased environmental demands



Grease and oil



Self lubricating bearings



Increased demands to regulate power output

New operating conditions

Service life?

Evaluating performance of self-lubricating materials for hydropower applications

- Developed test method
- Evaluate friction and wear
- Typical operating conditions

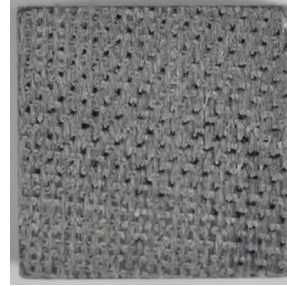
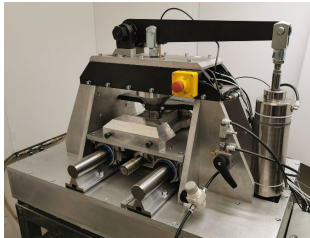


*Tribology of self-lubricating polymer composites for hydropower applications, Maria Rodiouchkina, Doctoral thesis

Evaluating performance of self-lubricating materials for hydropower applications

Friction and wear affected by:

- Contact pressure
- Sliding velocity
- Amplitude of motion
- Counter surface finishing

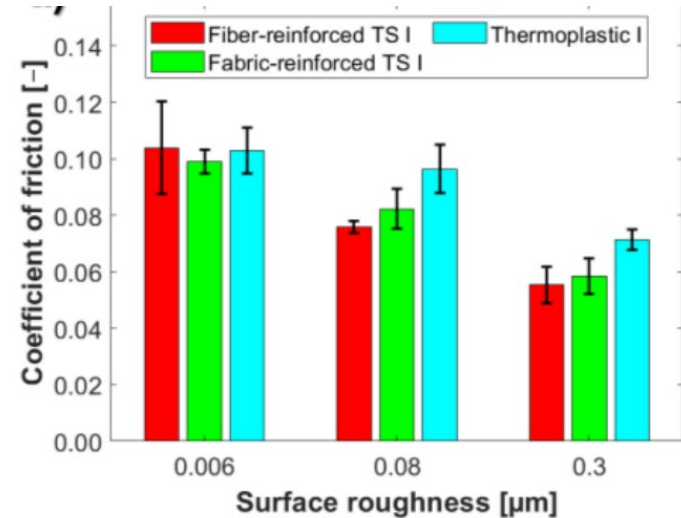


*Tribology of self-lubricating polymer composites for hydropower applications, Maria Rodiouchkina, Doctoral thesis

Evaluating performance of self-lubricating materials for hydropower applications

Informed decisions – selection of bearing materials

- Operating conditions
- Counter surface
- Water or dry

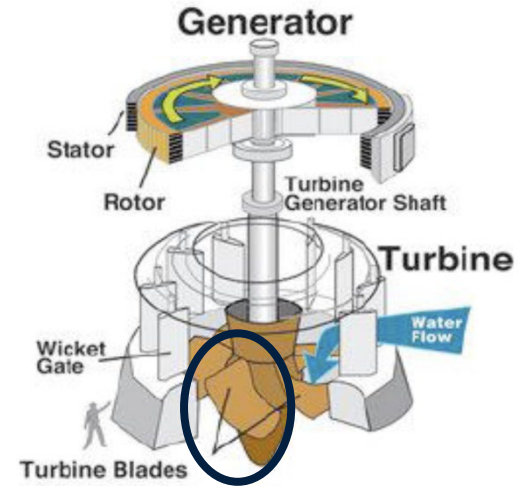


*Tribology of self-lubricating polymer composites for hydropower applications, Maria Rodiouchkina, Doctoral thesis

Prolonging service life?

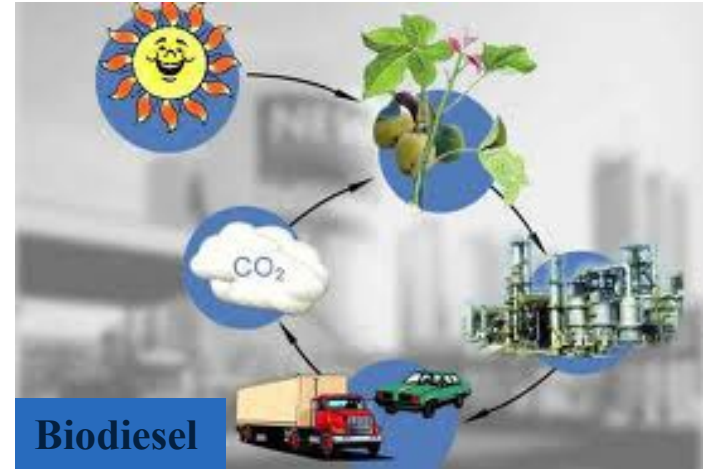
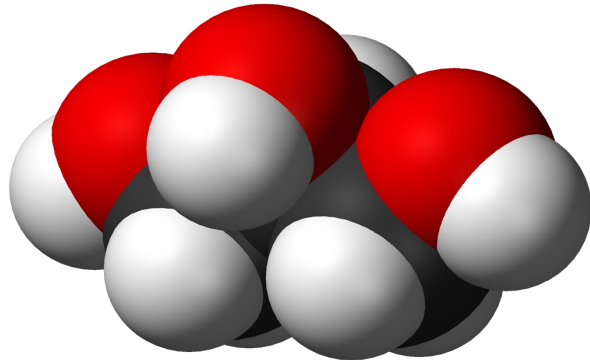
Increase in forces needed to move the turbine blade

- Bronze based bearing materials
- Often water filled hubs

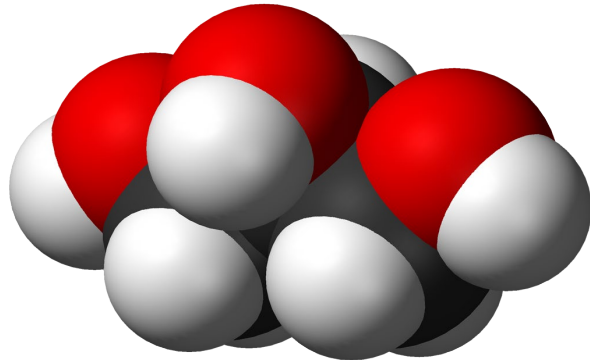


Glycerol – new environmentally acceptable biolubricant?

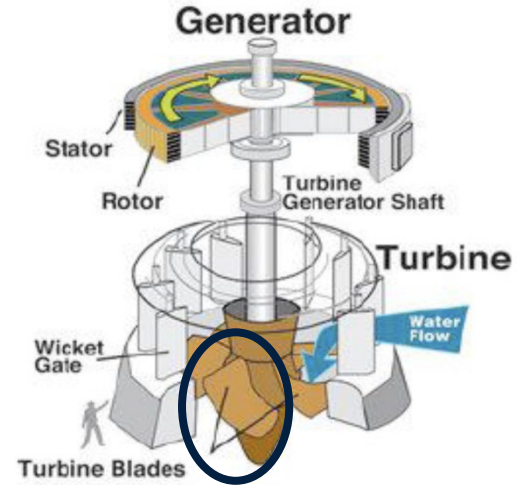
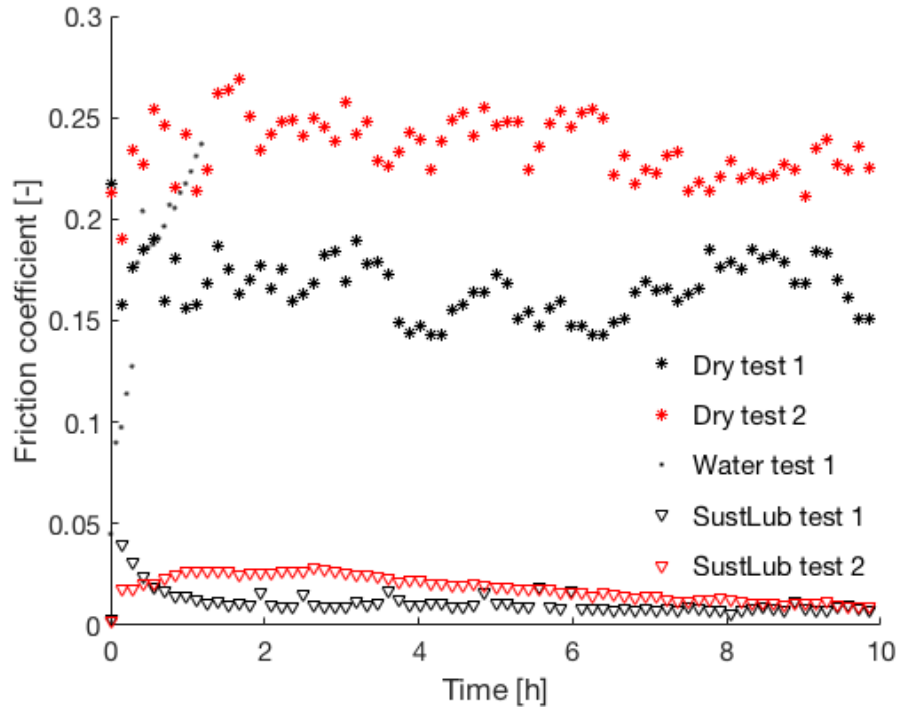
- Byproduct from biodiesel production
- E422 – toothpaste, skin cream...
- Not toxic
- Viscous
- Water soluble



Can glycerol be used to extend to reduce friction and extend the service life?



Glycerol results

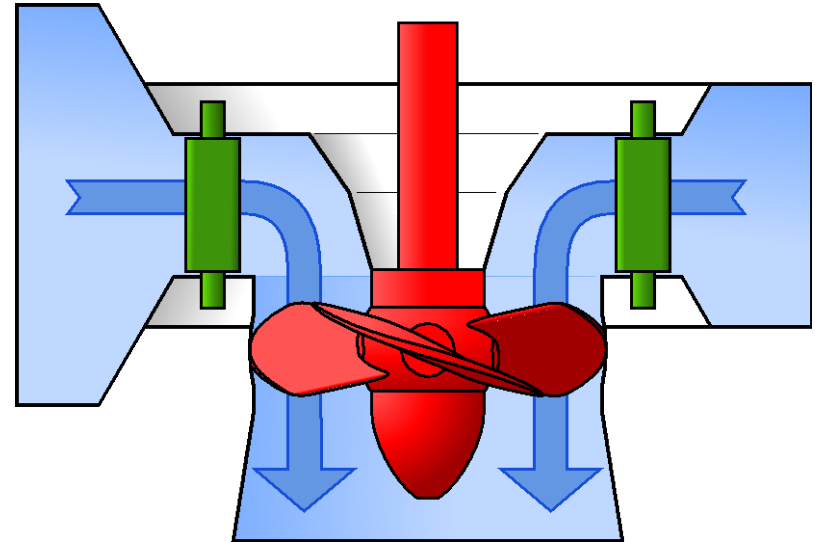


Condition monitoring and predictive maintenance

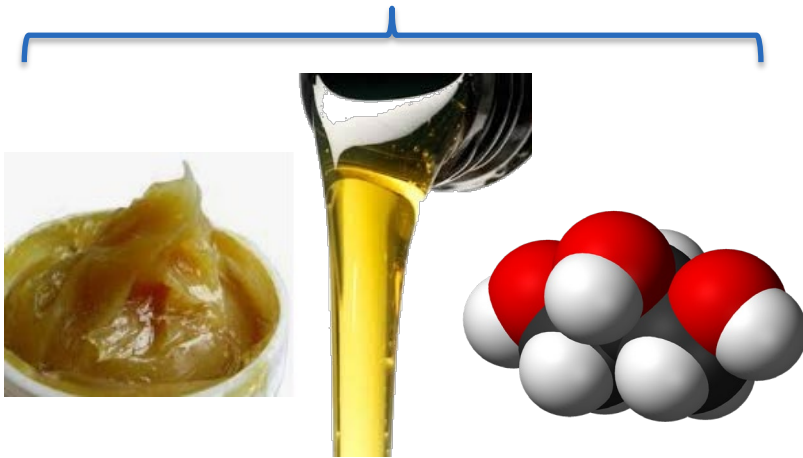
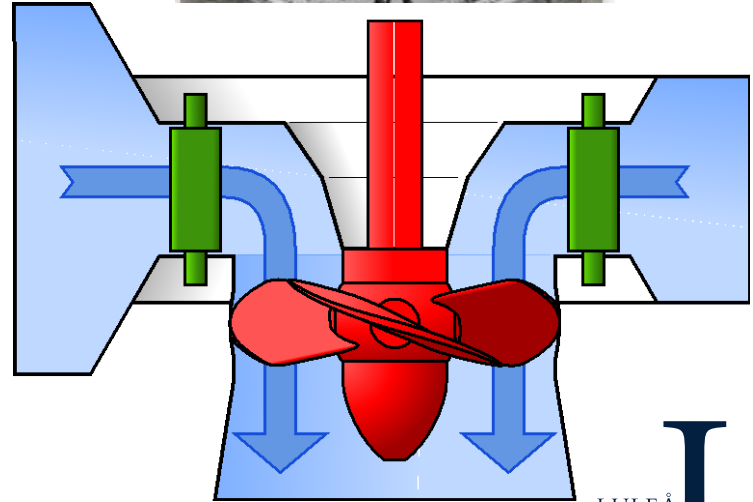
PhD-student Lars-Johan Sandström

Challenges in hydropower

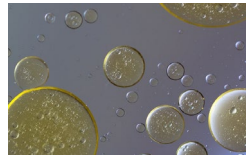
- Few faults
- Every turbine is unique
- Anomaly detection
 - Normal behavior
- Early detection



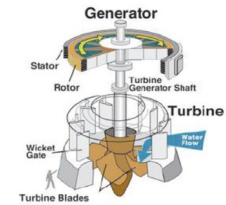
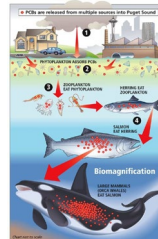
Direction of research



Direction of research



CO₂ +biomassa







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A large, white, serif capital letter 'L' is positioned to the right of the text, partially overlapping the words 'UNIVERSITY' and 'OF TECHNOLOGY'. It is the primary logo element for Luleå University of Technology.