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2014 – 2018

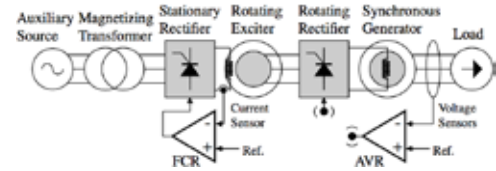
Remote controlled fast-  
response brushless  
rotating exciters for  
improved performance  
of hydrogeneratorsSupervisor:  
Urban Lundin

## Background

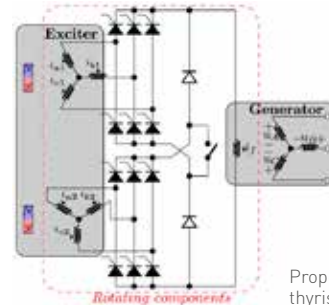
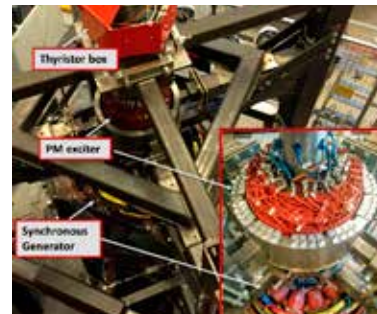
The grid code, FIKS, from the Norwegian Transmission System Operator (TSO), Statnett, states that synchronous generators  $\geq 25$  MVA, must have a static excitation system. However, an improved brushless excitation system is in operation on some commercial power plants (36MVA, 93.75rpm & 52 MVA, 167.67rpm) with grid-assisting performance beyond the conventional static system.

## Preliminary outcomes of the project

- A new era for large brushless hydro-generators is expected. If remote control is not allowed, a control signal through brushes should be employed instead.
- A six-phase exciter design with a hybrid-mode thyristor interface leads to improved redundancy, better controllability, minimized torque pulsations and reduced armature currents for the exciter.
- Proposed brushless system leads to reduced regular maintenance due to lack of slip rings and reduced unscheduled maintenance due to redundancy; both causing a reduced cost-of-energy.
- Permanent magnets on test rig is equivalent to constant field current control (FCR) of exciter in the commercial system.
- Excitation boosting (EB) is included in the brushless system without additional components or circuitry, leading to improved FRT-capability and PSS-actions.



Schematics of commercial brushless system (Voith)

Proposed hybrid-mode  
thyristor based interface

State-of-the-art experimental test rig (Uppsala)

## Future work

Extensive measurements and verification of the system on large-scale power plants.