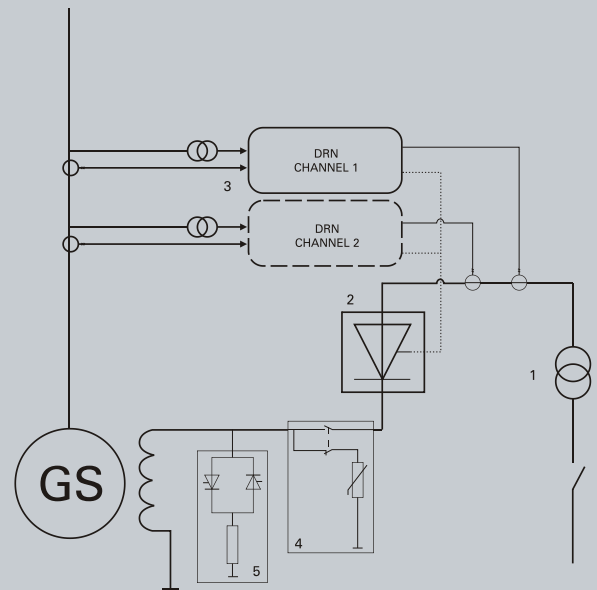# — Static excitation systems for turbo generators

Static excitation systems, controlled by microprocessor voltage regulator type DRN, are based on own hardware and software solutions. The development is based on over 50 years of activities on the area of electronics and regulation, 40 years of organised industrial production both devices and systems of power electronics and regulations and 25 years of applying micro processor control technology.

Končar excitation systems are operating in over 25 countries in the world.

APPLICATION AREA

Synchronous generators power larger than 5 MVA, supply voltage frequency 50 Hz, 60 Hz or 16 2/3 Hz and field current of 100Adc up to 5000Adc.

The supply of the main excitation system power circle is realised over excitation transformer connected to generator outputs (self-excitation connection) or from some other AC source (independent or external excitation) and thyristor converter in fully controllable six pulse bridge connection.

Digital voltage regulator DRN
Voltage regulator type DRN is realised as modular. DRN hardware is based on 16/32-bit processor Motorola, while the software support is realised on the regulation and control system DIREMK (Digital Regulation of Electric Machines Končar).

Basic characteristics:
- Two-channel configuration
- Independent regulator per field current
- Three phase generator current and voltage measuring
- Sampling of measuring variables via signal processor
- Possibility of extension of digital and analogue inputs and outputs

Additional functions:
- Possibility of additional functions via software modules, without additional hardware.

MAIN PARTS OF EXCITATION SYSTEM:

1. Excitation transformer
2. Thyristor converter
3. Digital regulator
4. De-excitation circle
5. Over-voltage protection

— Software support

BASIC FUNCTIONS
- Generator voltage regulator (PI type)
- Field current regulator (PI type)
- Limiters
    - Maximal field current
    - Maximal stator current
    - P/Q under excitation limiter
- Compensation per generator current
- Compensation per generator frequency
- Automatic follow-up
- Logical and sequential operation
- Integration into the plant control system
- Monitoring and self diagnostic

ADDITIONAL FUNCTIONS
- Power system stabilizer
    - according IEEE Std. 421.5 PSS2B
    - according IEEE Std. 421.5 PSS3A
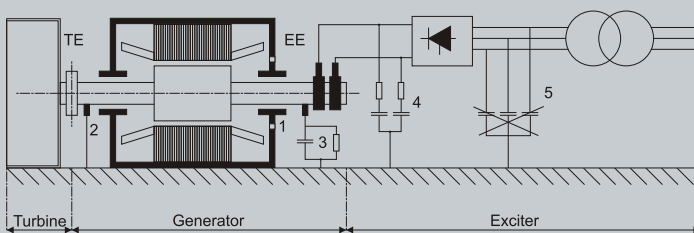- Q regulator
- Cosφ regulator

— Reduction and monitoring of shaft voltage

CAUSES:
- Magnetic asymmetry
- Axial shaft flux
- Electrostatic charge
- Static excitation

CONSEQUNCES:
Voltage between shaft and earthing can damage oil film and cause large damages of bearing.

THYRISTOR CONVERTER

- GTN   - natural cooling up to 1000 Adc
- GMP - forced air-cooling up to 530 Adc
- GTB   - forced air-cooling up to 2500 Adc
- MMF - forced air-cooling up to 5000 Adc

Possible configurations of converters:
- n - 1
- 1+1

Assembly for reduction of —
shaft voltage

- Braid for shaft earthing between generator and turbine
- Filter for shaft voltage decrease near slip rings
- RC filter on DC side of excitation for symetring of excitation voltage towards earth
- Filter on AC side of excitation

Digital voltage regulator continuously supervises shaft voltage and current through earthing.