Dr. Alberto Fragiacomo, graduated with PhD in Physics and Electrical Engineering.
He deeply knows the theoretical criteria of an SVC system and gives a support with measures to improve and optimize the Power Electrical Network System Stability.
He has a significant experience in High / Medium / Low Voltage PFC and SVC systems planning having experience of detailed engineering and Tests & Measurements, and commissioning regarding these kind of plants.

References & Work Experience:

1. **Electrical Networks Analysis :**
   - Power flows
   - Short circuit currents
   - Harmonic currents flow
   - Power systems & protections
   - Transient stability:
     - Electromechanical for CCT calculation for Network security
     - Electromagnetic
   - Electric circuits transients analysis, Electric arc
   - Power transformers up to 400MVA/400kV
   - Power generators up to 600MW

2. **Measurements & Tests after SVC system installation**
   - Power, energy
   - Electrical disturbances:
     - Conducted and radiated
     - Harmonics, flicker
     - Voltage fluctuations

3. **Experience in Special Electrical Machines design:**
   - Optimization of EAF/LF furnaces working with:
     - SVC & SVC light /STATCOM or saturable reactor up to +-250Mvar
     - DC arc furnaces up to 350MW
     - Synchronous machine for power generation up to 600-1000MW parallelize
     - Hydro, Gas and Steam Turbine, PV field and Wind turbine

4. **Project & Design of:**
   - Calculation and technical specifications starting from furnace basic data
   - Static var compensators
   - Power compensation harmonic filters:
     - Reactive power, Capacitors bank with Tuning reactors
     - Damping resistor
   - RC surge protections with arresters filters for circuit breakers and medium voltage
   - Single line diagram of SVC and drawing in steelmaking plants
   - SVC light/STATCOM with VSC power if necessary for better disturbances compensation

Measurements, Study and Calculations for the PowerCompensation of the AC/DC EAF/LF furnaces in a Steelmaking Plant and Electrical Networks Power Supply.

1. Measurements and Tests.

1.1. Measurements of harmonics, Powers Active/Reactive loads and analysis of the results (EAF-AC or EAF-DC and LF furnaces lines)
1.2. Analysis of the THD degree and RMS Voltage variation during operations with the new loads.
1.3. Measurement and analysis of the Sort-Circuit Power of the Electrical Power Supply incoming lines and secondary impedance of EAF-AC/DC arc furnace.

2. Electrical Study.

2.1. Drafting of EAF-AC/DC working curves with Furnace Transformer
2.2. Better Melting points and profiles for TAP to TAP Heat optimum operations.
2.3. Check of typical heat performance in terms of heat profile, power input, current level, refractory balance, electrode consumption and further key factors for melting
2.4. Calculus of the EAF-AC/DC Furnace Transformer working curves (Circle Diagram) per each Voltage range of the trafo, with filtered power factor correction SVC or Fixed Filters (with EAF and LF in operation).

3. EAF/LF optimizition

3.1. Drafting of AC/DC EAF working curves with Furnace Transformer
3.2. Formulation of the Reactance value for the Serial Reactor for an optimum operation.
3.3. Better Melting points and profiles for TAP to TAP Heat operations.
3.4. Calculus of the EAF Furnace Transformer working curves (Circle Diagram) per each Voltage Tap of the trafo, with filtered power factor correction SVC and taking All Tap Positions of the Series Reactors as parameter (with EAF and LF in operation).

4. Projects designs.

4.1. Design of the Static Var Compensator (SVC)
4.2. Design of the Fixed Filters Compensator (FC)
4.3. Design of the new Furnace Transformer
4.4. Design of the new Series Reactors
4.5. Design of the SVC for the EAF-AC/DC
4.6. Issue of relevant Technical Specification to inquire for Offers from Suppliers.
4.7. Technical evaluation of Offers.
4.8. Design of the Furnace transformer for the AC/DC EAF furnace
4.9. Design of the Series Reactors with the new Furnace transformer for the EAF-AC/DC
4.10. Issue of relevant Technical Specification to inquire for Offers from Suppliers.

5. Electrical Network Study.

5.1. Complete study of the electrical network connected to the Electrical Power Supplier grid (HV, MV)
5.2. Evaluation of the impact caused by the new loads on the MV kV distribution line (for instance, Load Flow, Harmonic Flow, Short-Circuit Currents).

6. Power Systems Relaying.

6.1. System Relaying protection, Planning, Setting and Coordination (HV, MV, LV).
6.2. Single line of Furnace by HV step down transformer to LV high current secondary circuit.

Check up of the Systems on EAF and LF Furnaces, Post SVC System installation

1. **EAF/LF furnace operation**

- Installation of a measurement system for arc furnace analysing and operation reporting
- Check of typical heat performance in terms of heat profile, power input, current level,
- refractory balance, electrode consumption and further key factors for melting
- Setup of circle diagrams and operating tables

2. **EAF/LF electrodes regulation**

- Check and calibration of current and voltage measurement
- Check of closed-loop control for electrode regulation system
- Hydraulic speed tests to analyse valve characteristic, accuracy, wear, mast roller performance.
- Dip tests to establish high current system data
- Discussion for improving hydraulic and control system

3. **Steelmaking plants Check of electrical protection system**

- Analysing VCB-breaker trips during opening (RC-Filter design with surge arresters)
- Read-out and check relay settings for EAF-breaker and back-up breakers
- Analysing necessary protection level for transformer and switchgear, relay settings and coordination

4. **EAF/LF Improvements operations**

- Implementation of modified Heat power profiles
- Testing of new transformer/reactor taps and current levels (impedance set points)
- for different main melting phases
- Electrical balancing of furnace operation in order to symmetrise and to lower refractory wear index

WEMES Consulting
AF - Engineering
Dr. Alberto Fragiacomo